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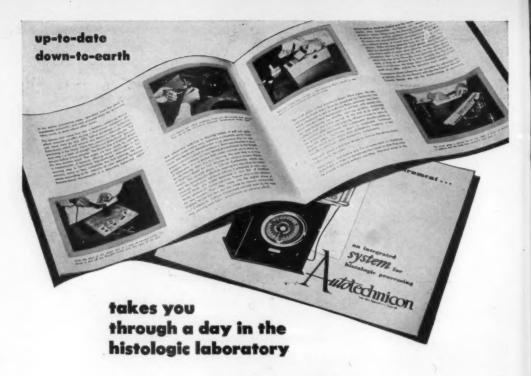
NUMBER 2963

### Contents

The Need for General Laws in the Social Sciences:  E. W. Leaver and J. J. Brown
Arnold Sommerfeld: 1868-1951: Linus Pauling
Technical Papers  A New Class of Hypnotics: Unsaturated Carbinols: S. Margolin et al.
The Life Span of the Red Blood Cell in Chronic Leukemia and Polycythemia: Nathaniel I. Berlin, John H. Lawrence, and Helen C. Lee
Tissue Cytochrome c and Prevention of Experimental Atherosclerosis: J. Mardones et al.
A Selective Medium for the Isolation of Coccidioides immitis: Lucille K. Georg, Libero Ajello, and Morris A. Gordon
The Experimental Production of Lipid Deposition in Excised Arteries: Sigmund L. Wilens
Mango Grafting in Eight Weeks: L. B. Singh
Temperature-dependent Characteristics of an Adenyl- pyrophosphate Preparation from Potatoes: Kwan-Hua Lee and John J. Eiler
Nudibranch Spicules Made of Amorphous Calcium Carbonate: Howard T. Odum
The Heparinoid Nature of a Serum Mucoprotein:  Ezra M. Greenspan
The Percutaneous Absorption of Water Vapor: C. W. DeLong
Comments and Communications
Robert Chambers, Knut Faegri, Israel S. Kleiner, R. R. Newell, and Harry A. Wilmer
Book Reviews
Culture Worlds; Nutrition and Chemical Growth in Childhood; Handbook of Human Engineering Data for Design Engineers
News and Notes
Lobbying for Science
Meetings & Conferences

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### Lobbying for Science

THE recent action in the House of Representatives, cutting 98 per cent from the funds requested by the Administration for the National Science Foundation, reveals a problem and points a moral. Announcement of the action late in August precipitated a spate of activity on the part of scientific societies, college presidents, professors, and others. At this time it is not known what the Senate will do about the appropriation, nor how the matter will be decided by a conference committee of both the Senate and the House. But it is safe to say that the National Science Foundation will receive less money than it would have, had the House Appropriations Committee been convinced of the need for the full amount. Apparently, no one made the least effort to convince these legislators.

The foundation itself can perhaps be excused. Officers presented the original request last April, but Alan T. Waterman took office only in late March. As director, he had to know in detail just why he was asking for \$14,000,000, and this kind of knowledge takes time to accumulate. The organizations and individuals who make up the scientific and engineering fraternity in this country cannot be excused, however. They can be said to have failed to exercise their fundamental right of petition. This is even more inexcusable when the competent battle led by scientific societies for passage of the bill authorizing a National Science Foundation is remembered. Congress was forgotten once the authorizing legislation was passed. Even the greenest newcomer to Washington knows that the big battle takes place when the appropriation comes up for a vote.

"Lobby" is a word with nasty connotations. It must be remembered, however, that a lobbyist is a man who is exercising the fundamental right of petition. There are good lobbyists and bad lobbyists, lobbyists working on large salaries and larger expense accounts to "buy" Congressmen, and lobbyists working with next to no money for a cause in which they believe.

A lobbyist for the scientists might have saved the day for the National Science Foundation. What does a competent, honest lobbyist do? First, he informs the people he represents about what is happening of interest to them on Capitol Hill; in the case of the NSF, he would have informed scientists that the appropriation was in trouble long before the House Appropriations Committee voted on it. Second, he is a technician who knows best how to direct the action of a group of citizens with a common interest in petitioning Congress. In this case, members of the House Appropriations Committee would have been made aware last spring of the interest of voters in their districts, and of the scientific fraternity as a whole, in this appropriation. Third, he is a liaison man between the people he represents and Congressmen. He gives the Congressmen an understanding of the problems and aspirations of his people insofar as they relate to legislative action. He educates the Congressmen. In this case, he would have made members of the House Appropriations Committee see the vital importance of fundamental research and of the need to train new scientists.

When this note appears, the fight on the NSF appropriation will be over. Science will have won or lost. But science will still need a lobbyist. Every scientist is aware of the increasing interlocking of science and everyday events, of science and politics. An ever-increasing proportion of scientists work for the government, or on contract with the government. What scientists do has a direct bearing on the immediate political and economic future of all people, and their legislative representatives are therefore directly concerned. Bills to hamper scientific freedom, bills that may misdirect natural scientific trends—these and possibly some good bills will be coming up spasmodically. Congress needs to act intelligently and with a background of knowledge. Whether we like it or not, only a lobbyist can provide that knowledge and intelligence.

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### The Need for General Laws in the Social Sciences

E. W. Leaver and J. J. Brown

Electronics Associates Ltd., Toronto, and Aluminum Company of Canada, Ltd., Montreal, Canada

INCE 1850 MEMBERS of informed scientific circles have been spared much toil inventing perpetual motion machines because of the existence of the law of conservation of energy. In the same way immense effort in the fields of business and politics will be saved once the existence of analogous general laws in the social sciences has been demonstrated. It is now important that we find such general laws because the world is becoming more and more highly integrated.

Man, his works, his world of ideas, his environment, and his society together constitute a totality that has not been consciously comprehended as a thing-initself. This totality, for want for a better name, we call the sociocosm. Two of the more important properties of the sociocosm are its high degree of integration and the great rate at which this integration is increasing. Man is a biological organism embedded in the sociocosm, and the two are growing at different rates. Stresses thus set up between man and the matrix in which he is embedded cause tension, helplessness, and strife. Because of its fundamental properties the sociocosm is continually outgrowing man's ability to cope with it. Dilemmas in the fields of business, polities, and economics, which have arisen in the past and will continue to arise, have their source in our failure to comprehend the existence, let alone the properties, of the sociocosm. Only a study of the sociocosm, together with a determination of its fundamental laws, will show whether these surface dilemmas can be resolved.

#### THE NEED FOR GENERAL LAWS IN THE SOCIAL SCIENCES

The different views as to how men are to be arranged into the good society have precisely the same status. They are merely the expression of individual preferences, which in turn are the results of different environmental and hereditary conditions. All these theories, we suggest, are probably mistaken, because they are erected on foundations that consider only a small fraction of the factual data now available. It one happens to be right, it is nothing more than an inspired guess.

In much the same way, for two hundred years before 1850, such learned journals as the Philosophical Transactions of the Royal Society had their pages crammed with methods for attaining perpetual motion. Machines were being invented, not by crackpots, but by the best scientific minds of the generationmen of the caliber of Newton, Huygens, and Hooke.

An immense amount of labor went into the design and construction of such machines, and into the individual criticism of theories and mechanical embodiments that accompanied their publication. Toward the middle of the nineteenth century this debate (which had been carried on in a desultory fashion since the time of the ancient Greeks, and intensively since the rebirth of physics that came with the Renaissance) came to an abrupt end. Such work as Count Rumford's experiments to show the equivalence of heat and work and Joule's numerical calculation of the mechanical equivalent of heat permitted a great generalization: the law of conservation of energy. This general law permitted men to solve questions dealing with energy on a theoretical level, without building a mechanical model, and without wasting time on the criticism of individual mechanical embodiments. The relatively advanced state of the physical, as opposed to the social, sciences is largely the result of this law. The law of conservation of energy is still immensely useful for cutting through the mass of detail surrounding a problem and coming up quickly with the correct answer based on theoretical considerations alone.

Today we stand badly in need of some general laws dealing with the dynamics and statics of societysomething analogous to the "law of conservation of energy" and "principle of least action" in physics. Some of our best minds are engaged in studying the multitudinous detail of the social sciences, and often an entire lifetime is devoted to the study of one small aspect of one society. The monographs and learned articles pile up, and the social sciences become more complicated every day. To cut through this increasingly thick jungle of detailed reports, we need some fundamental laws. If we had such laws we would be able for the first time to give direction to research. We would know immediately what was possible and what was not possible, without having to perform costly experiments to establish the field. In the social sciences many experiments are inconclusive, and others require decades for results, when quick solutions are of vital

What is needed is study of the totality—the superintegration we call the sociocosm-with a view to discovering some of the general laws governing its operation. We believe that such laws exist, and that even the elementary discussion of the totality that follows brings some of them to light. Once formulated, these laws can be used for the criticism of modern social theories on a scientific basis; for the formulation of a basic policy for research in the social

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sciences; and for the eventual development of social theories that have a demonstrable scientific relationship with the facts.

The element we are accustomed to call "society" is itself a complex organization of man, his works, and his environment. It is, to coin a word, the integron of man, machines, institutions, products, accumulated culture. The particular integron that is the result of the interplay of environment, the dynamics of institutions, individuals, and ideas, we call the sociocosm. The sociocosm, of course, is the "world" as seen from the point of view of man; it is a homocentric view of the universe.

Dilemmas in the fields of business, politics, and economics, which have arisen in the past and will continue to arise, have their source in our failure to comprehend the existence, let alone the properties, of the sociocosm. History is the description of events resulting from the interplay of forces between and among the elements making up the sociocosm. The multifarious interactions of the constituent elements mean that, to understand them properly, we must treat them as components of a still greater and more universal type of integron—namely, the sociocosm.

There is probably a whole group of laws governing this integron. The determination and study of these laws, and their application to problems in the various aspects of social science might lead to a more rational world or, at least, would provide greater opportunity for rationality to operate. As a minimum, such research would probably tell us which problems are ultimately soluble, and which are not. But the formulation of such a set of laws is not the purpose of this paper. We propose merely to describe the five properties of the sociocosm which seem to us most significant, in the sense that they appear to have the most immediate application to today's needs.

### SOME PROPERTIES OF THE SOCIOCOSM

The sociocosm is a unique type of integron—different from the biological organization<sup>3</sup> of cells into a living organism, and also different (because of the different order of integration) from the organization

<sup>2</sup> So little thinking has been done about this totality that there is no word for it in any of the modern languages. In this paper, to "integrate" various elements means to arrange them in such a way that they affect each other. A highly integrated group is one in which the components influence each other in multitudinous ways. The entity that results from integrating (which may be only a concept, and not a physical thing at all) we call an integrow.

<sup>2</sup> By this we do not intend to support Berkeley's contention that the world is a thought phenomenon of man. We mean simply that the geometry of the sociocosm is warped to emphasize man's peculiar interests and desires. To give a graphic example: Say the cosmos were laid out on a grid of Cartesian coordinates drawn on a rubber sheet, and a pencil were shoved up at one point on the sheet, stretching the rubber into a sharp peak. Man is at the top of the peak looking down, so the squares nearest him seem immensely large and important, and those farther away seem small.

It is important to distinguish between organization and integration. In this discussion, a highly organized group is one in which the line of control is clearly drawn, and the dominance of some of the elements clearly established; a highly integrated group is one in which every element affects every other element.

by means of which men act together in an institution or in society. Although the sociocosm has always been with us, it is not a familiar concept. Therefore, to describe its properties, we propose to compare it with something that is well known—namely, a biological organism such as man. The five properties that are deemed especially significant are (1) degree of homogeneity of the components; (2) degree of integration; (3) rate of change of the degree of integration; (4) degree of organization; and (5) degree of approach to man's own ideals.

1. Degree of homogeneity of the component parts. One striking difference between the biological organism and the sociocosm lies in the uniformity of the component parts. In the biological organism various cells have various functions, such as defense, control, alimentation, repair, reproduction; but they all belong to the same class of thing. They are all cells. In social organizations, on the other hand, the components that perform the different functions are often not members of the same class. A bus, for example, is not the same as a man, yet both are components of the transport system.

As society becomes more complex, there seems to be a definite tendency toward mixed components. In transportation, men first used their own legs and then, later, were carried by animals. Up to this point all the components of the system were at least living creatures and belonged to the same general class. But now the transportation function is performed by an odd combination of machines and men, to the astonishment of the gods and the occasional undoing of man bineals.

The function of protecting the organism from external enemies shows the same divaricate tendencies. The crab has its own specialized cells that form a protective plate; societies take several different classes of entities—machines, chemicals, words, and men—and form them into a complicated protective device.

The recent development of so-called thinking machines shows this same tendency to get some sort of nonliving entity that is different from man to perform one of man's specialized functions. Instead of developing our own brain cells to the point where they can work at the speed required, we work up a different class of entity—an aggregation of electron tubes, wires, resistors, and condensers—to do our "thinking" for us.

The sociocosm therefore differs from the living organism in that its components include different kinds of things, whereas the individual components of an organism are all the same kind of thing.

2. Degree of integration. One of the main elements of the sociocosm is the individual human being. One of the main elements of the biological organism is the individual cell. It is obvious that a human being is intrinsically a more complicated element than a cell and, moreover, it has the ability to stimulate other human beings over a longer time, through a greater distance, and in a greater number of different ways, than one cell has to stimulate another. In view of our

definition of integration, as depending on the degree to which interstimulation is possible, the sociocosm, on this basis alone, is more highly integrated than any

biological organism.

In audition, when we consider the extent to which man has turned the inanimate world to his own purposes, and the effects that the resulting products and environment have in turn upon man, it is apparent that there is still further interstimulation, increasing the disparity in degrees of integration between the biological organism and the sociocosm. Therefore, considering all the elements of the sociocosm and their interactions, the degrees of integration as between a biological organism and the sociocosm will be seen to be of different orders of magnitude. For example, the transfer of information from one place to another is achieved both by biological organisms and by technology, which is one element of the sociocosm. The organism uses nerves: technology has settled, for the moment, on the use of copper wire and electromagnetic waves. The use of inanimate things instead of nerves for the transmission of intelligence has permitted greater distances to be covered and more information to be sent in a given time.

3. Rate of change in the degree of integration. Comparing a biological organism (such as the physiological man) to an organization, from the point of view of the rate at which the degree of integration of the two is changing, it is apparent that the development of organizations is taking place at a different order of speed. Judging by the human skeletons dug up by archaeologists, man of 250,000 years ago was not vastly different physiologically from modern man. On a smaller time scale, artifacts of the Egyptians and ancient Greeks show that the men and women of those days were essentially the same as men and women today. If, by some accident of time, they were to appear on a bathing beach, we would pass them without a second glance. On the other hand, the basic organizations (which are among the slowest entities that change in the sociocosm) were certainly of a very primitive type 100,000 years ago and cannot be compared to those existing today. Even the institutions that were in existence 6,000 years ago are only very feeble foreshadowings of the modern type in degree of complexity.

The same tendency can be seen operating in the world of ideas. The various concepts of men—justice, truth, liberty, social responsibility, humanitarianism, equality—have grown up at an amazing rate in the past three hundred years. In fact, some very fundamental ideas in our society have developed in the

past fifty years.

That the biological organism (man) changes at a much slower rate than do most components of the sociocosm is evident in the products of human industry, such as the automobile, motorized wheel chair, and various methods of communication, which could very easily make legs unnecessary within fifty years. Obviously, no type of biological evolution that we know of could possibly eliminate human legs in fifty

years. Comparable biological changes have taken place, but only over periods of time of the order of perhaps a million years. Biological evolution cannot possibly keep up with the development of products of our industrial organization.

The products of our embryo machine civilization and the machines for making these products are developing at such a tremendous rate that they cannot be compared to those of only fifty years ago. Surely, then, the sociocosm, which is the totality of all these machines, products, men, and organizations, is changing at a much faster tempo than man, the most adapt-

able biological organism known.

4. The degree of organization. In Brave New World Aldous Huxley described a society in which human beings were deliberately modified in the pre- and postnatal period so that in life they would be capable of performing a very limited range of functions, and those functions only. This is the true biological method. The degree to which this seems ludicrous or horrible is the measure of the distance separating the biological and the social forms of organization.

The parallels between the organization of a group of cells in an organism and that of a group of men in a society are numerous enough to have attracted the attention of philosophers, but, when examined, they turn out to exist chiefly on the superficial level. When we go behind these surface similarities, fundamental differences appear at once. For example, under the microscope even the layman can see a radical difference between a bone cell and a muscle cell. But on a Sunday excursion boat it is very difficult to tell the difference between a day laborer and an artist. The biological method of organization is to warp individual cells so they can each perform one separate function in an integrated whole; the social method of organization is to take individuals all essentially the same and leave them as unchanged as possible,

Individuals in our society are so similar that a man may be a laborer in his youth and a captain of industry in middle age. The idea that all men are equal is very tenaciously held in our society, partly because it is an essential ingredient of the democratic ideal, but also because it contains this core of truth: the most striking differences between men are completely insignificant when compared to the differences be-

tween specialized cells.

When we compare the control systems of a biological organism and a social organization, we see an even more striking difference. The simplest organism is far more highly organized than the strictest totalitarian state. In spite of the well-known fact that the cortex is influenced by the rest of the body, in any sane individual the cortex controls behavior more or less explicitly. In the social organism, on the other hand, the explicitness of control is not only poorly defined, it is commonly not certain that it exists. Interactions up, as well as down, the control structure are the normal thing in social organizations—a fact that accounts for de Maistre's remark that "every country has the government it deserves." No society has anything really

corresponding to the central nervous system of biological organisms. There is no single control element, corresponding to a brain, which determines the course of our actions. On the contrary, as a society we are pushed this way and that according to the vagaries of pressure groups, mass hysteria, or sheer accident.

The biological organism is so completely and intimately organized that only cells could possibly be members of such an organization. The lowest slave under the most ferocious totalitarian state could never achieve the degree of submission required by the or-

ganic type of organization.

5. The degree of approach to man's own ideals. When the biological organism (man) is compared with one aspect of the sociocosm (society) from the point of view of their respective degrees of approach to man's own ideal of conduct, human dignity, social responsibility, and justice, it is found that the biological organism is very far from this ideal, and the sociocosm relatively near.

Man is an intelligent creature for a very short period each day, an emotional creature for a somewhat longer period, and a plain unfeeling and unthinking animal for most of the day. Since we can harbor humanitarian or intelligent ideas for only a very short period, and since the time of occurrence and the duration of these periods are not predictable, we have been led to set up rules and organizations to perform these functions for us when we are otherwise engaged. Organizations of this type are governments, police departments, humane societies, libraries, churches, social service groups, schools, and universities. By means of these and similar organizations, society caters to the ideals of the individual. The organizations provide man with continuity of operation, over-all policies, and day-to-day functioning in the field of humanity, human discipline, general housekeeping, education, and religious life.

That the social conscience is closer to the ideal than the average individual conscience (averaged over a reasonable time interval) can be further shown by contrasting the official government attitude toward minority groups with the attitude of the average individual. Here in Canada our government has no official policy of persecuting the Jews, but most of the individuals in our society who are not Jews privately want them persecuted and do it in various small ways, as opportunity offers. Since our government and all the institutions mentioned above are components of the sociocosm, it follows that the latter more closely approaches the ideal set up by man for himself than does the biological aspect of man.

The sociocosm, then, differs in every aspect we have examined from the biological organism. It has a much greater variety of components; its degree of integration is so much higher it is of a different order of magnitude; the rate of change of this integration is very much faster; the degree of organization is far lower; and, finally, the sociocosm has been found to exhibit a relatively close approach to man's own ideals. These points are enough to establish the fact

that the sociocosm is a distinct type of entity—an integron of organizations, of a complexity unlike anything we are familiar with in our own lives.

THE SOCIOCOSM AND CONTEMPORARY PROBLEMS

Any society is more complex than the individuals of which it is composed, since the very fact of organization adds something that was not there before. The higher the form of social organization, the greater is the gap between the developmental level of the society and that of the individual. The rate at which an organism changes is a function of the number of interstimulations that can occur per unit time. As time goes on and the organization increases in complexity, obviously the number of interstimulations per unit of time must increase also-i.e., the rate of change must increase. In the case of biological organisms the number of different ways in which interstimulation can occur is relatively small, and the growth of the organism is more a matter of organization than of integration. But with the sociocosm the number of different ways in which interstimulation can occur is large, and its growth has been more in the field of integration than of organization. Hence the number of ways in which interstimulation can occur is rising at a very rapid rate. The disparity between the two is a measure of the difficulty man experiences in coping with the problems presented by the sociocosm.

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It is often said that political organization is behind the times, but it is not. It is only behind the peak level of thought of certain highly gifted individuals who appear only rarely in each generation. Political organization is always well above the level of average thinking of average individuals. Some evidence to support this belief can be seen by comparing the way even a small state government runs its affairs with the way the average voter runs his life. The latter, by

comparison, is a shambles.

The rapid development that is characteristic of complex structures makes man unable to cope with his environment. Obviously, "formula" solutions are incapable of realization. The statement of a problem is the first step to its possible solution. The problem is this: Since, by their very nature, organizations must develop faster than their components, the dilemmas caused by the difference in developmental rates cannot fail to arise. If man wants to increase the degree of advancement of his civilization, or even survive at the present level, he is faced with a greater and greater necessity of finding an escape from, or diversion around, this fundamental law of organizations. One possible escape from this dilemma is to conceive of the organization as being external to the individual; then the individual can extricate himself insofar as is possible from its exorbitant mechanical demands. The tendency should be for individuals, instead of trying to integrate themselves with the machine civilization, to stay outside it, enjoying its material provisions, but avoiding its stultifying effect on the spiritual and creative faculties.

### Arnold Sommerfeld: 1868-1951

### **Linus Pauling**

Gates and Crellin Laboratories of Chemistry, California Institute of Technology, Pasadena

A ENOLD SOMMEBFELD, who, at the age of eightytwo, died on April 26, 1951, of injuries suffered in a traffic accident, was one of the
great leaders in theoretical physics of the
past generation. In the importance of his contributions to the development of the old quantum theory
of the atom he takes second place only to Niels Bohr.
As a teacher and leader in theoretical physics during
the period 1910-35 he was preeminent.

Sommerfeld's greatest contribution to atomic physics, his development in 1916 of a relativistic theory of the fine structure of spectral lines, excited great interest among physicists; and, even though the theory was later modified in its details by the changes required by quantum mechanics and the electron spin, its striking success stimulated physicists all over the world to the further development of quantum theory as applied to problems of atomic and molecular

structure.

Arnold Johannes Wilhelm Sommerfeld was born December 5, 1868, in Königsberg, East Prussia. He received the degree Dr. Phil. in Königsberg in 1891. From 1893 to 1897 he served as assistant in the Mineralogical Institute in Göttingen and as assistant to Felix Klein in the Mathematical Institute. His Habilitation was made in 1895 on the basis of his famous work on the mathematical theory of diffraction. From 1897 to 1900 he was professor of mathematics at the Mining Academy in Clausthal, and he then served as professor of mechanics at the Technische Hochschule in Aachen from 1900 to 1906. From 1906 until his retirement in 1935 (he continued lecturing until 1938) he was professor of theoretical physics in the University of Munich, as successor to Boltzmann. Throughout this period in Munich he presented lectures in theoretical physics that were outstanding for their clarity. Many able students were attracted to his Institute for Theoretical Physics, including a number of Americans, especially during the years following his trip to the United States in 1922, when he served as Karl Schurz professor at the University of Wisconsin and visited many other universities. He returned to the United States in 1928 as visiting professor at the California Institute of Technology. Among his students and associates in the Institute for Theoretical Physics were M. von Laue, W. Heisenberg, P. Debye, P. P. Ewald. W. Pauli, Jr., P. S. Epstein, G. Wentzel, K. F. Herzfeld, H. Ott, F. London, W. Heitler, E. Guillemin, V. Guillemin, K. Bechert, F. G. Slack, E. C. Kemble, L. Pauling, Carl Eckart. H. A. Bethe, O. Laporte, P. M. Morse, A. Land', R. Peierls, A. Unsöld, W. V. Houston, and E. U. Condon. As Heisenberg said on Sommerfeld's eightieth birthday, not only did Sommerfeld have students—he developed practically a whole generation of theoretical physicists, who are now widely distributed over the world.

The breadth of his interests was extraordinary, ranging from the construction, with E. Wiechert, of a harmonic analyzer in 1892 through the study of methods of solution of differential equations, the treatment of the transmission of radio waves over the earth's surface, the search for empirical numerical relationships in the spectra of atoms, and many other subjects, to the investigation of the most complex problems of quantum theory. His first great work was the writing of four volumes on the theory of the spinning top, in collaboration with Felix Klein. He then served as editor of the volume on physics of the Encyclopädie der mathematischen Wissenschaften, and soon became interested in quantum theory and atomic structure.

The first great event in Sommerfeld's institute came in 1912. Sommerfeld had suggested to P. P. Ewald that as his doctoral research he investigate the behavior of electromagnetic waves with wavelengths in the optical region in a lattice of atoms, as in a crystal. Some theoretical considerations of Wien and Sommerfeld had suggested that x-rays might have wavelengths about 10-0 cm, and that they were to be considered as electromagnetic waves. Max von Laue, who was Privatdocent in Sommerfeld's institute, then had the idea, during a discussion with Ewald, that x-rays should produce a diffraction pattern on passage through a crystal. The experiment was carried out by Friedrich, Sommerfeld's assistant, and Knipping, a student; and on June 8, 1912, Sommerfeld communicated to the Munich Academy of Sciences a description of the work showing the wave nature of x-rays.

After his development in 1916 of the relativistic quantum theory of the fine structure of the hydrogen spectrum and of x-ray doublets, Sommerfeld prepared the first edition of his great book Atomban und Spektrallinien, which went through four more editions between 1921 and 1929. The English translation, Atomic Structure and Spectral Lines, from the third edition, appeared in 1923 and was widely adopted in the United States and elsewhere as a textbook for advanced courses. In 1929 there appeared his Wellenmechanischer Ergänzungsband, which was expanded and published in 1939 as Volume 2 of Atomban und Spektrallinien.

Sommerfeld wrote hundreds of papers, dealing with the theory of diffraction, the fine structure of atomic spectra, the electronic theory of metals, the theory of chemical valence, and many other subjects. During the last years of his life he collected his lecture notes into a series of six books, entitled Lectures on Theoretical Physics. The successive volumes cover mechanics, the mechanics of deformable media, electrodynamics, optics, thermodynamics and statistics, and partial differential equations of physics. All these volumes except the one on thermodynamics and statistics have appeared in English translation as well as in German; he had nearly completed the manuscript for this volume at the time of his death. Like his earlier books, these works are characterized by extraordinary clarity of expression and argument.

Sommerfeld received many honorary degrees and awards, and was honorary member of many scientific academies. Two years ago the American Association of Physics Teachers presented to him the Oersted

Medal, in recognition of his outstanding contributions as a teacher of physics. Additional recognition of Sommerfeld's contributions as an investigator and a teacher was given by his students in four memorial volumes: the book Probleme der modernen Physik, celebrating his sixtieth birthday, the December 1938 issue of Physical Review, celebrating his seventieth birthday, the book Cosmic Radiation, fifteen lectures edited by Heisenberg and given in honor of Sommerfeld's seventy-fifth birthday, and the August-November 1948 issue of the Zeitschrift für Naturforschung, honoring his eightieth birthday. The hazard of a mechanized world has prevented his students from celebrating during his lifetime still further anniversaries of the birth of this great man, who retained his extraordinary mental vigor and acuity up to the end.

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### Technical Papers

A New Class of Hypnotics: Unsaturated Carbinols

S. Margolin, P. Perlman, F. Villani, and T. H. McGavack

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Recent pharmacological investigation (1) has shown that certain ethinyl tertiary carbinols (2) exhibit significant hypnotic activity in several species (mice, rats, guinea pigs, rabbits, cats, dogs, and monkeys). Hypnotic effects followed oral as well as parenteral administration of the compounds. Earlier investigators have described the induction of generalized central nervous system depression in experimental animals with tertiary carbinols (3). The only tertiary carbinol to attain clinical use as a hypnotic is amylene hydrate, a saturated compound (4, 5). In our studies, the simple unsaturated aliphatic carbinols were found to possess high activity, desirable duration of action, and low toxicity. Of the latter group, 3-methyl-pentyneol-3,1 was considered worthy of extensive pharmacodynamic, biochemical, and clinical study. Its structural formula is

$$HC \equiv C - CH_s - CH_s$$

Barbiturate potentiation in the mouse (6) and direct hypnotic activity in dogs were used to evaluate quantitatively the oral hypnotic efficacy of the test compounds. The hypnotic effect was characterized by

 $^{1}$  Dormison, trade-mark of Schering Corporation, Bloomfield, N. J.

the appearance of a distinct and sequential reaction pattern—sedation, loss of righting reflex, and sleep. An interesting parallel in relative hypnotic activity for 3-methyl-pentyne-ol-3 and other hypnotics was found in experimental animals and in man (Table 1). (The value of 100 has been arbitrarily assigned to pentobarbital sodium.)

TABLE 1

ORAL ACTIVITY OF 3-METHYL-PENTYNE-OL-3 AND OTHER HYPNOTICS IN EXPERIMENTAL ANIMALS AND IN MAN

Drug	Human dose (mg/70 	Relative activity			
Drug		Man	Dog	Mouse	
3-Methyl-pentyne-ol-3	250	40.0	20.0	71.9	
Amylene hydrate	1500	6.7	10.0	20.0	
Paraldehyde	5000	2.0	4.3	4.6	
Phenobarbital	100	100,0	50.0	100.0	
Pentobarbital sodium	100	100.0	100.0	100.0	
Presidon	300	33.3	20.0	33.3	

3-Methyl-pentyne-ol-3 is distinguished by a high selectivity of action. When measured in rats at the maximal tolerated dose, according to a modified Wolff-Hardy procedure (7, 8), it was not analgesic (1). The absence of analgesic effect was confirmed in mice and dogs. No anesthesia was observed when the compound was administered intravenously to dogs in sublethal amounts. This absence of anesthetic properties was observed in mice and rats also (1). When tested according to the in vitro Magnus-Dale technique, 3methyl-pentyne-ol-3 was found not to possess antispasmodic action. Furthermore, in marked contrast to barbiturates and other hypnotics, 3-methyl-pentyneol-3, even in large doses, did not depress respiration. Caffeine given parenterally caused rapid recovery from the deep hypnotic state induced by overdoses.

No undesirable aftereffects have been observed in animals given overdoses of the drug.

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Several members of the class were tested for acute toxicity in rodents and dogs by oral and parenteral routes. Among these, 3-methyl-pentyne-ol-3 was notably low in toxicity. The acute oral LD50 for mice, rats, and guinea pigs, ranged from 600 to 900 mg/kg. The animals died in a state of coma. A few active compounds with low acute toxicity were tested for chronic toxicity in mice, rats, and dogs. 3-Methyl-pentyne-ol-3 at 200-300 mg/kg/day (approximately 70 times the recommended human dose) did not produce any gross or micropathological changes. Blood sugar levels, hemoglobin values, and erythrocyte, white blood cell, and differential counts were normal. Dogs that had received chronically 3-methyl-pentyne-ol-3 per os showed normal renal function (phenolsulfonphthalein test).

In metabolic studies on 3-methyl-pentyne-ol-3, the acetylenic hydrogen was used to identify and estimate the compound through the formation of the silver acetylide and the microdetermination of silver (9). Following the oral administration of 3-methyl-pentyne-ol-3 (200 mg/kg) to adult dogs, 0,5-4.6% of the total dose was excreted in the urine during the first 24 hr; thereafter, only traces could be detected. In preliminary trials, no drug was detected in the urine obtained from three human subjects during a 60-hr period after a single oral dose of 100 mg. It was estimated that no more than 8% of the total dose could have been present in any 4-hr specimen. Following intravenous administration to dogs (200 mg/kg), it was found that the blood contained during the first 10 min 20% of the total dose; no drug could be detected in the blood at 2 hr. Analyses of rat tissues (brain, spleen, kidney, adipose, muscle, and liver) taken while the animals were still under the hypnotic action of 3-methyl-pentyne-ol-3 (800 mg/kg), revealed that adipose, muscle, and liver tissues together contained approximately 20% of the total dose. No unchanged compound was found in any of the organs or tissues when the effects of the drug were no longer manifest. In vitro experiments in which 3-methyl-pentyne-ol-3 was added to whole blood from dogs and rats indicated that there was no breakdown of the compound; i.e., the acetylenic hydrogen was still present. However, slices of kidney or liver, and to a lesser degree slices of brain, changed this molecule in such a way as to render it nonreactive with the silver reagent (9).

In a clinical study in 134 subjects, the majority of whom previously required barbiturates for sleep, 3methyl-pentyne-ol-3 was found to be highly active, without toxic effect, and free from undesirable side actions (10). The effective oral dose in adults was 200-300 mg. Sleep was brought about in the majority of patients in less than 1/2 hr. The patients who received 3-methyl-pentyne-ol-3 experienced restful sleep and had no "hangover" upon awakening. A number of patients have been given daily doses of the compound for more than 6 months without any untoward effects. Complete blood counts, urinalyses, blood sugar, blood urea nitrogen, creatinine, total serum protein, albumin, globulin, phosphorous, alkaline phosphotase, total cholesterol, free and combined cholesterol, and in addition, the icterus index, Van den Bergh, thymol turbidity, or cephalin flocculation values were determined, before and after medication with 3-methylpentyne-ol-3. These clinical laboratory tests indicated that there were no pathological changes attributable to the drug.

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### The Life Span of the Red Blood Cell in Chronic Leukemia and Polycythemia1, 2

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The anemia associated with leukemia and neoplastic diseases is still not completely understood; infiltration of the bone marrow in some cases, with crowding out of the erythropoietic tissue, has been postulated as a significant factor in the pathogenesis of the anemia. However, Huff and co-workers (1) have shown with radioactive iron that in some patients with leukemia the rate of production of red blood cells was greater than the 0.8% per day that would be anticipated if the cells lived a normal life span of approximately 120 days (2). These same workers showed that in polycythemia vera the rate of production of red cells was much greater than 0.8% per day. These findings may be explained by postulating a decrease in the life span of the red blood cells in these diseases. Using N15-labeled glycine, which Shemin and Rittenberg (2) demonstrated to be a specific precursor of the porphyrin of hemoglobin, London et al. (8) found a normal life span of the red blood cell in a single case of polycythemia vera.

Since C14-labeled glycine has been shown to be satisfactory for the labeling of rat hemoglobin (4, 5) and for the determination of the life span of the red blood

<sup>1</sup>This study was supported in part by the Atomic Energy Commission and the U. 8. Public Health Service. <sup>2</sup>Presented before the American Federation for Clinical Research, Atlantic City, N. J., May 1, 1951.

cell of the dog (5,6) and rat (7), studies (8) utilizing  $C^{14}$ -methyl-labeled glycine were undertaken to determine the red blood cell life span in patients with

leukemia and polycythemia.

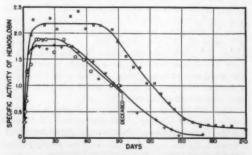
Three patients with chronic leukemia, one with lymphatic and two with myelogenous, and two patients with polycythemia vera were given intravenously 8.6 mg of glycine 2-C14 containing 100 µe of C14. Blood samples were drawn at frequent intervals, and the hemoglobin was extracted by a modification of the method of Drabkin (9). The plasma was removed by centrifugation, the cells were washed three times with saline and then lysed with distilled water; the lipids were extracted with toluene. After standing overnight, the solution was centrifuged and an aliquot of the clear hemoglobin solution was dried in vacuo and combusted to CO2 by the method of Van Slyke and Folch (10). This was precipitated as BaCO3; a 1-g aliquot was converted to CO2 and the specific radioactivity measured in a 100-ml ionization chamber (11), using a vibrating reed electrometer and recording poten-

Figs. 1 and 2 show the graph for the specific activity of hemoglobin as a function of time in the three patients with leukemia (Fig. 1) and one patient with

polycythemia vera (Fig. 2).

Fig. 1 shows that the red blood cells in one patient with chronic lymphatic leukemia in clinical and hematological remission at the time of these studies had a normal mean life span (110 days), and that in the two patients with myelogenous leukemia who were anemic there is considerable shortening of the mean life span of the red blood cell, from a normal of approximately 120, to 71 and 76 days, respectively. If the bone marrow in these patients continued to produce a normal number of red blood cells per day, and if these lived only 70 instead of 120 days, it is then evident that these patients will become anemic. Therefore, in leukemia, a significant factor in the pathogenesis of the anemia is the decrease in the life span of the red blood cell.

Fig. 2, which shows the specific activity of the hemoglobin as a function of time in one of the patients and is typical of both patients with polycy-



F10. 1. The specific activity of the hemoglobin in disintegration/min/mg BaCO<sub>2</sub> as a function of time. Three patients with chronic leukemia.  $\square$  = Chronic lymphatic leukemia; +,  $\bigcirc$  = chronic myelogenous leukemia.

themia vera, may be analyzed in the following manner: The graph from a period of 40-200 days is qualitatively similar to that of the normal and to the leukemic, so that in these individuals there is at least one class of red blood cells that had an almost normal life span; the rapid initial rise and fall in the first 15 days may be analyzed by considering this as due to the delivery into the peripheral circulation of a second class of red blood cells with a life span of only

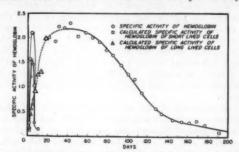


FIG. 2. The specific activity of the hemoglobin in disintegration/min/mg BaCO<sub>a</sub> as a function of time in a patient with polycythemia vera (Patient H. M.).

a few days. If the long-lived cells are delivered into the peripheral circulation at a rate consistent with a first-order process, which is what Shemin and Rittenberg (2) found, then, by determining the rate graphically in the interval 20-40 days after administration of the radioactive glycine, the curve for the specific activity of this class of cell may be extrapolated to the origin. The difference between the extrapolated curve for the long-lived cells and the observed specific activity is due to the presence of the short-lived cells, and so the curve for the short-lived cells may be constructed. It is assumed in the above discussion that in both classes of red blood cells the hemoglobin within the cell is not exchangeable and that the removal of the hemoglobin and the red blood cell from the circulation is the same process.

Huff and his co-workers (1), in their radioactive iron studies, have presented evidence which "may indicate that the longevity of red cells in polycythemia vera is significantly shortened." The present results show that such short-lived cells do exist, but that there is also present a class of cells with a normal life span. It is the rapid turnover of these short-lived red blood cells that is largely responsible for the greatly increased rate of utilization of iron for the formation of hemo-

globin in this disease.

Further studies involving particularly the separation of the hemoglobin into the constituent porphyrin and globin moieties are in progress.

These studies may necessitate a revision of our present concept of the mechanism of the anemia occurring in neoplastic disease.<sup>3</sup>

Since the submission of this manuscript three additional anemic patients with chronic lymphatic or myelogenous kukem's have been studied and found to have red cells with decreased life span.

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### Tissue Cytochrome c and Prevention of **Experimental Atherosclerosis**

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It has been shown that the protective action of iodides on the experimental atherosclerosis induced in rabbits by cholesterol-rich diets is exerted through the thyroid, since iodides are not effective in the absence of the gland (1, 2) or when given simultaneously with thiourea (2).

Drabkin (3) has pointed out that there is a clear positive correlation between the thyroid activity and the content of cytochrome c in the tissues. Consequently it seemed important to investigate whether changes will occur in the cytochrome c content of tissues of rabbits on a cholesterol-rich diet with potassium iodide, in the presence and in the absence of thyroid gland.

Rabbits on a cholesterol-rich diet (nearly 0.5 g cholesterol, in the form of cattle spinal cord, daily) and with constriction of the upper abdominal aorta inducing hypertension, which acts synergistically with diet in producing atherosclerosis (4), were divided into 4 groups: one control, another with thyroidectomy, and two on protective doses of potassium iodide (0.3 g orally every other day), one of them thyroidectomized. The animals were sacrificed 120 days after starting the diet. The development of atherosclerosis was judged macroscopically and evaluated on a scale of 0 to 10 (4). The cytochrome c of liver and kidney was extracted by the method of Potter and Du Bois (5) and determined spectrophotometrically according

to Rosenthal and Drabkin (6). The results on liver eytochrome c are given in Fig. 1. The changes in kidney cytochrome c were similar to those in the liver.

The correlation coefficient between liver cytochrome c and development of atherosclerosis is r = -0.533, with t = 2.88, a value regarded as statistically significant.

These findings confirm, in the rabbit, Drabkin's results in the rat (3) of the influence of the thyroid

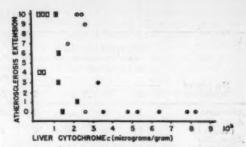


Fig. 1. Relationship between liver cytochrome c and degree of atheroscleros's in rabbits on cholesterol-rich diet, sacrificed at 120 days. Squa es, thyroidectomized; circles, normal; open squares and circles, animals without treatment; solid squares and circles, animals given potassium iodkie.

gland and thyroxine upon the level and content of cytochrome c in tissues. It is deduced from the data that the action of iolide may be one of stimulation of the thyroid gland, since the concentration of cellular cytochrome c is increased when the drug is administered to animals with thyroid. The results furthermore suggest that the augmentation of cellular cytochrome c must be considered as a factor in the prevention of the experimental atherosclerosis by means of potassium iodide.

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### A Selective Medium for the Isolation of Coccidioides immitis

### Lucille K. Georg, Libero Ajello, and Morris A. Gordon

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Cultural procedures commonly used in attempting isolation of Coccidioides immitis from clinical specimens or from the physical environment frequently fail because of overgrowth of the pathogen by saprophytic fungi and bacteria. Laboratory tests indicate that a newly developed medium shows great promise in overcoming this difficulty.

Sabouraud dextrose agar fortified with penicillin (20 units/ml) and streptomycin (40 units/ml) was selected as a basal medium. This combination is inhibitory to most bacteria but does not prevent the growth of fungi, except the actinomycetes.

On the basis of the findings of Leach, Ford, and Whiffen (1), Whiffen (2), and Phillips and Hanel (3), which demonstrated the selective antifungal ac-

	Sabouraud dextrose			Sabouraud dextrose agar + penicillin and streptomycin* +								
	agar + penicillin and streptomycin*			Actidione I (0.1 mg/ml)		Actidione II (0.5 mg/ml)			Actidione III (1.0 mg/ml)			
No. days of incubation	2	5	8	2	5	8	2	5	8	2	5	8
Alternaria Aspergillus	1+	4+	4+	0	2+	3+	0	2+	3+	. 0	1+	2+
(Strain 1) Aspergillus	4+	4+	4+	0	3+	3+	0	0	0	0 -	0	0
(Strain 2)	4+	4+	4+ '	0	1+	2+	0	0	0	0 .	0	0
Fusarium	2+	4+	4+	0	0	0	0	0	0	0	0	0
Helminthosporium Hormodendrum	0	3+	4+	0	0	0	0	0	0	0	0	0
(Strain 1) Hormodendrum	1+	4+	4+	0	1+	2+	0	1+	1+	0	1+	1+
(Strain 2)	3+	4+	4+	. 1+	4+	4+	1+	3+	4+	0	2+	3+
Mucor	3+	- 4+	4+	0	1+	2+	0	0	0	0	0	0
Oospora	1+	4+	4+	0	0	0	0	0	0	0	0	0
Paecilomyces Penicillium	3+	4+	4+	0	0		0	0	0	0	0	0
(Strain 1) Penicillium	1+	4+	4+	0	3+	3+	0	1+	2+	0	1+	2+
(Strain 2)	3+	4+	4+	0	2+	2+	0	0	0	0	0	0
Rhizopus	4+	4+	4+	0	0	0	0	0	0	0	0	0
Scopulariopsis	2+	4+	4+	0	3+	3+	0	1+	2+	0	0	1+
Trichoderma	2+	4+	4+	0	1+	2+	. 0	0	0	0	0	0
Coccidioides immitis (3 strains)	1+	3+	4+	1+	3+	4+	0	2+	3+	0	2+	3+

Penicillin, 20 units/ml, and streptomycin 40 units/ml.

tivity of actidione, this antibiotic was added to the basal medium. These workers showed that actidione was active against a variety of saprophytic fungi as well as a few of the human pathogens, but concentrations as high as 1.0 mg/ml of medium were found not to inhibit C. immitis.

Actidione is soluble in water in amounts up to 2%, and solutions are stable for several weeks at pH 3-5. For this investigation, stock solutions of actidione were prepared in aqueous potassium di-hydrogen phosphate (M/15), sterilized by filtration and stored at  $5^{\circ}$  C. Measured quantities were added to sterile Sabouraud broth or to sterilized, melted, and partially cooled Sabouraud agar in combination with penicillin and streptomycin.

Three strains of *C. immi'is* recently isolated from active cases of coccidioidomycosis were used in these studies, as well as 15 strains of common saprophytic fungi comprising 12 different genera.

The degree of resistance of *C. immitis* to actidione was tested by adding 0.1 ml of a dilute suspension of washed spores (approx 100 spores/ml) of this organism to a series of tubes of Sabouraud dextrose broth containing graded amounts of the antibiotic, and incubating at 25° C for 1 week. At the end of this period no inhibition of growth of *C. immitis* was observed in tubes containing as much as 1.0 mg of actidione per ml. Very slight inhibition was seen in tubes containing 2.0-4.0 mg actidione/ml.

Washed spores of a series of common saprophytic The Upjohn Company, Kalamazoo, Mich.

fungi, as well as of the 3 recently isolated strains of C. immitis, were then inoculated on slants of the basal medium containing varying concentrations of actidione and on controls without actidione. The tubes were incubated at 25° C, and growth was recorded as 1+ to 4+ after 2, 5, and 8 days. No inhibition of growth of the 3 strains of C. immitis was observed on media containing 0.1 mg actidione/ml. Colonies first appeared on the second day and could be identified by the fifth day. Although colonies were slower to appear on media containing 0.5-1.0 mg/ml, they also were readily identifiable by the fifth day. Detailed results of this experiment are recorded in Table 1.

Attempts were made to isolate C. immitis in culture from a mixture of its spores with those of the 15 saprophytes. Spore suspensions of equal densities were prepared from washed packed spores of each of the saprophytic species. These were combined and a suspension of washed C. immitis spores (approx 2,000 spores) was added. Calculating on the basis of the volumes of packed spores used, there were approximately 2,000 times as many saprophytic spores as C. immitis spores in the mixture. A series of agar plates with and without actidione was inoculated by placing 0.5 ml of a saline suspension of the spore mixture on the surface of one plate and streaking it serially by means of a bent glass rod over 3 additional plates. After 3 days of incubation the plates containing no actidione were covered with a heavy growth of the saprophytic fungi and no colonies of C. immitis were detectable. On the first of a series of plates con-

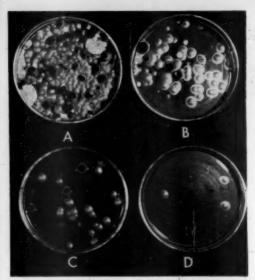


Fig. 1. Isolation of C. immitis from a mixture of sapro Fig. 1. Isolation of C. swamis from a mixture of saprophytic spores. A mixed spore suspension was placed on plate A, which contained 0.5 mg actidione/ml basal medium, and serially spread on plates B, C, and D, which contained the same medium. A few saprophytic colonies can be seen on plates A, B, and C; but the grey, slightly moist, dome-shaped colonies of C. immits can be seen on all the plates, and appear in pure culture on plate D.

taining 0.1 mg actidione/ml, C. immitis colonies were recognizable but were overgrown with saprophytes, whereas on the remaining plates of the series saprophytic growth was negligible and many isolated colonies of the pathogen appeared. On a series containing 0.5 mg actidione/ml, the growth of the saprophytes was further restricted, and, even after 12 days, the plates contained C. immitis in almost pure culture (Fig. 1).

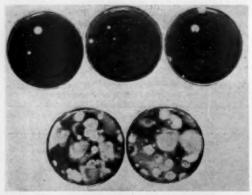


Fig. 2. Exposure of actidione media to the air for 4 hr. Plates in top row contain 0.1, 0.5, and 1.0 mg actidione/ml. The two plates below contain no actidione. After incubation. a few suprophytic fungus colonies appeared on the actidione plates, but the control plates were covered with the growth of saprophytic fungi.

The effectiveness of the actidione media in suppressing the growth of airborne saprophytic fungi was tested by exposure of plates out of doors for periods of 1-6 hr. The plates contained 0, 0.1, 0.5, and 1.0 mg of this antibiotic per ml. After exposure, the plates were covered and incubated at 25° C. After 6 days only a very few restricted colonies of saprophytic fungi had developed on the plates containing actidione, whereas the controls were completely covered with saprophytes (Fig. 2).

These preliminary tests suggest that 0.1 mg actidione/ml of the basal agar may be of value in the isolation of C. immitis from the air, whereas the higher concentrations, 0.5-1.0 mg/ml, might be required for isolation from more heavily contaminated

Field tests of these media are in progress.

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### The Experimental Production of Lipid Deposition in Excised Arteries

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Anitschkow (1), after many years of investigation, was of the opinion that there is normally a constant passage of fluid through the walls of arteries in the direction from the lumen to the adventitia. He believed that atherosclerosis resulted from disturbances in this fluid transport. Little effort has been made to substantiate or disprove this simple hypothesis. A series of experiments was therefore undertaken to study the filtration properties of excised human arteries.

During the course of these experiments, it was observed that visible lipid would deposit in the tissues of normal arteries if normal human blood serum was filtered through its walls at normal arterial pressures for 24 hr or longer. The present communication is a preliminary report of this observation.

Common and external iliac arteries were removed at necropsy1 within 24 hr of death from individuals 19-26 years of age who had died suddenly following trauma. They were rinsed in 0.9% saline and the loose adventitial adipose and areolar tissue removed. One end of the vessel was made watertight by inserting a short glass rod with a bulbous tip and ligating it in position with coarse soft thread. The other end was fastened with a similar ligature to a glass cannula. This was then attached to a manometer system, and the internal air pressure raised slowly to 300 mm Hg. The distended vessel was then submerged in saline to

<sup>1</sup> The arteries were obtained through the courtesy of Mil-ton Helpern, Robert Fisher, and Henry Weinberg, of the Medical Examiner's Office of the City of New York.

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TABLE 1

CHEMICAL COMPOSITION OF POOLED HUMAN SERUM FILTERED THROUGH EXCISED EXTERNAL ILIAC ARTERIES

Pressure (mm Hg)	Serum	Total choles- terol (mg/%)	Total protein (mg/%)	Albumin globulin ratio (mg/%)	Calcium (mg/%)	Non- protein nitrogen (mg/%)	Chlorides (mg/%)
45	Before filtration Retained in artery	323	7.2	4.5/2.7	11.6	30	130.4
	after filtration Filtrate	None	11.5 2.5	6.4/5.1 $1.4/1.1$	8,4	30	113.6
145	Before filtration Retained in artery	323	7.6	4.5/3.1	10.4	28	126.4
	after filtration Filtrate	552 25	14.1 2.65	7.8/6.3 1.5/1.15	12.8 9.2	32	112.0 108.0
245	Before filtration Retained in artery	215	7.5	5.7/1.8	10,25	-	-
	after filtration Filtrate	None	11.5 3.4	6.5/5.0 $2.8/0.8$	5.76	-	_
320	Before filtration Retained in artery	323	7.2	4.5/2.7	11.6	30	-
	after filtration Filtrate	663 43	15.2 3.8	7.8/7.4 1.2/2.6	8.4	30 33	=

test for leaks and minute nutrient vessels. The latter are present in about one of every five iliac arteries and are somewhat more frequent in the common than in the external iliac artery. Points of leakage were easily determined by escaping air bubbles. Only vessels that were leakproof at 300 mm Hg were used.

Pooled serum of human blood donors and of patients drawn within 24 hr of the test was obtained from the Serology Laboratory at Bellevue Hospital. This was aspirated into a graduated 5-ml pipette, and the latter was attached in a vertical position to a manometer. The cannula at one end of the arterial segment was attached by rubber tubing to the lower end of the pipette, all air bubbles dislodged, and the pressure adjusted to the desired level with due allowance for the length of the column of serum above the vessel. The approximate inner surface area of the distended vessel was calculated from its length and external diameter. The rate of filtration was determined by measuring the amount of serum lost from the pipette during the first 4 hr of filtration at room temperature and expressed for convenience as ml of filtrate/hr/100 cm2 of intimal surface. The distended artery was placed in a test tube and the filtrate collected.

Total cholesterol (Bloor), total protein, albumin/globulin ratios, calcium, nonprotein nitrogen, and chloride determinations were done on the original serum, on the fluid left in the vessel after 24 hr of filtration and on the filtrate obtained. From these determinations and from the volumes of filtrate and serum retained with the vessel lumen, the amounts of cholesterol and protein that had been retained in the vessel wall were computed.

The filtrate differed so strikingly from the original serum in appearance and chemical composition that it is obvious that it had diffused through the tissue of the arterial wall and had not escaped through leaks or minute intramural vasa vasora. The fluid was

watery, very pale yellow, and had lost its opalescence. It contained only minute amounts of cholesterol or none at all and relatively little protein. In some instances the globulin was completely removed by filtration. The albumin content was reduced. The filtrate contained 25–50% less calcium than the original serum, indicating that much of the protein-bound fraction had been removed. Inorganic substances such as chlorides and nonprotein nitrogen were present in approximately the same concentration in the filtrate, in the retained fluid within the vessel lumen, and in the original serum.

The serum retained within the lumen of the vessel was viscid and dark yellow, especially after prolonged filtration. The cholesterol content of the retained fluid was markedly increased. Values of 600 mg% were not uncommon. The protein content, especially the globulin fraction, was also greatly increased and in some instances the albumin/globulin ratio was reversed. The calcium content was moderately elevated. Sample protocols are shown in Table 1.

It is obvious, therefore, that large molecular sub-

TABLE 2

FILTRATION RATE OF SERUM THROUGH ARTERIAL WALLS AT VARYING LEVELS OF PRESSURE

	Rate of filtration (ml/100 cm <sup>2</sup> surface/hr)					
Pressure (mm Hg)	Common iliae artery	External iliae artery				
20	0.0	0.0				
30	.29	.40				
45	0.59	0.92				
70	1.04	1.12				
120	1.56	1.22				
170	1.36	2.29				
245	3,64	2.26				
320	4.91	2.71				

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TABLE 3

CALCULATED AMOUNT OF CHOLESTEROL RETAINED IN WALLS OF EXCISED ILIAC ARTERIES AFTER
FILTRATION OF POOLED HUMAN SERUM

Filtration	01 41	Serum retained in lumen and filtered	Serum retained in lumen	Filtrate	Cholesterol retained in artery wall (cale)		
pressure (mm Hg)	Observation				mg	%	
45	Volume (ml)	5,3	2.5	2.8	_	_	
	Cholesterol mg% Cholesterol mg	323 (initial)	452	None	-	-	
	(cale)	17.12	11.30	4.6	5.82	34.0	
95	Volume (ml)	9.4	4.0	5.4	-	_	
	Cholesterol mg% Cholesterol mg	270 (initial)	522	None	_	_	
	(cale)	25.38	20.88	6.4	4.50	17.7	
120	Volume (ml)	5.8	3.4	2.4	-	-	
	Cholesterol mg% Cholesterol mg	270 (initial)	279	None	_	-	
	(cale)	15,66	9.49	44	6.17	38.1	
145	Volume (ml)	8.9	3.0	5.9	-	-	
	Cholesterol mg % Cholesterol mg	303 (initial)	519	85	-	-	
	(cale)	26.97	15.57	5.02	6.38	23.7	
245	Volume (ml)	6.0	2.0	4.0	_	_	
	Cholesterol mg % Cholesterol mg	215 (initial)	566	None	-	-	
	(cale)	12.90	11.32	6.6	1.58	12.3	
270	Volume (ml)	10.7	4.2	6.5	_	_	
	Cholesterol mg% Cholesterol mg	190 (initial)	. 380	60	_	-	
	(cale)	20,33	15.96	3.90	0.47	2.3	
320	Volume (ml)	6.2	2.7	3.5	_	-	
	Cholesterol mg% Cholesterol mg	323 (initial)	496	None		-	
	(cale)	20.03	13.49	6.6	6.54	32.6	

stances do not readily enter the arterial intima within the range of filtration pressures tested (20-320 mm Hg). At 20 mm Hg pressure no fluid filtration occurred. At 30 mm Hg a very slow rate of filtration was noted. At increasing pressures the rate of filtration was correspondingly accelerated (Table 2), but the character of the filtrate was essentially unchanged.

By calculation (Table 3), it was found that 20-50% of the cholesterol present in the original volume of serum filtered could not be accounted for by concentration within the lumen of the vessel. It was concluded, therefore, that some of the cholesterol had entered the arterial wall and had been retained within it. It was estimated that 2-38% of the cholesterol in the filtration system was deposited intramurally. Similar computations revealed that a small proportion of protein was consistently lost during filtration and was presumably deposited intramurally. The relative amounts of cholesterol and protein retained in the vessel wall did not depend upon the pressure level of filtration. These did increase with the length of time of filtration, but there was considerable unexplained variation in individual experiments.

The presence of lipid in the arteries was confirmed by Sudan IV staining of frozen sections (Figs. 1, 2). After 18 hr of filtration at high pressures a light diffuse deposit of lipid was usually observed in the intima of the artery. This was most pronounced at the proximal end of the arterial segments. If filtration was con-

tinued for 36-48 hr at 200-300 mm Hg, sufficient lipid had accumulated in the entire exposed intimal surface to give a reddish color when the artery was stained in toto with Sudan IV. The amount of lipid deposited depended chiefly upon the amount of fluid that had filtered through the vessels per unit of surface area. It also depended to some extent upon the original thickness of the fibrous intima and for this reason was generally more pronounced in the thicker common iline than in the external iliac artery. At physiological blood pressures (75-125 mm Hg) scanty lipid deposits were first noted after 24 hr of filtration. The lipid material appeared to spread uniformly throughout the entire thickness of the intima in some instances; in others, it had concentrated at the internal elastic lamella. The latter often acted as an effective barrier against the further penetration of lipid material. There was no tendency to lipid droplet formation, and the lipid in the impregnated intimal tissue was not doubly refractive.

At points where ligatures had been applied and the intimal tissue crushed, lipid often had penetrated through the media but was arrested at its junction with the adventitia. In several experiments where high filtration pressures were used, stainable lipid material in appreciable amounts had diffused through the media and had concentrated at its external margin. After prolonged filtration at high pressures, the media were impregnated with lipid throughout. There is little doubt, however, that the intact internal elastic

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lamella serves as a resistant barrier to serum cholesterol, whereas the intimal surface is semipermeable to this material as constituted in normal human blood serum.

The artificial conditions of experiments on excised nonviable arteries are such that it is impossible to state that filtration of blood serum occurs during life through the walls of arteries in an identical manner. There are several circumstances that suggest that the mechanism of filtration observed does reflect in some measure what may occur physiologically. The filtration properties of excised arteries are fairly constant and are not altered appre liably by post-mortem changes. If two vessels are obtained from a person within a few hours of death and one is tested immediately and the other after 48 hr in the icebox, no significant change in rate or character of filtration is noted. Second, the semipermeability of the arterial wall to serum constituents is similar to that which exists in capillary walls in vivo. Third, the pre-sure threshold of filtration at 20 mm Hg is very close to that at which capillary filtration is believed to occur. Furthermore, the arterial wall retains much of its physical characteristics after it has lost its viability; for example, its elastic properties are not greatly altered. It is noteworthy that arterial grafts obtained up to 28 hr after death have been successfully transplanted (2).

It is possible, therefore, that the filtration of serum

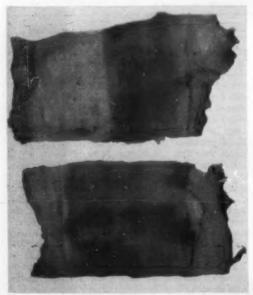


Fig. 1. Photomicrograph of intimal surfaces of common illac arteries stained with Sudan IV after being distended with serum at 300 mm Hg for 48 hr. The pink-stained lipid-containing areas appear as broad dark grey bands that are sharply outlined from the paler borders of intimal surface that lay outside the zones of distension. The dark punctate areas in the upper specimen are points at which the internal elastica was ruptured and lipid penetrated into the media.

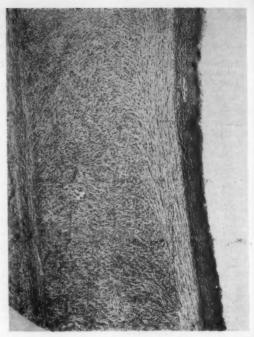


Fig. 2. Photomicrograph of Sudan IV-stained frozen section of illac artery distended with serum for 48 hr at 100 mm Hg. The intima is uniformly impregnated with darkly stained lipid.

through excised arteries may not be totally dissimilar to what obtains during life. The filtration properties of the vessel wall may depend more upon the size and character of interstices in the framework of the vessel than upon the permeability of living cell membranes. The character of intimal lipid deposit produced artificially so closely resembles that occurring spontaneously in the very stages of arterial lipid deposition that it is likely that a somewhat similar mechanism is involved in both processes. There is no reason to believe that an inert membrane such as the internal elastic lamella should change very greatly within a few hours of death. It is suggested, therefore, that the filtration of serum through artery walls under the conditions of the experiments provides direct and substantial evidence in favor of the filtration theory of lipid deposition in atherosclerosis.

The failure of cholesterol to pass freely through capillary walls is generally attributed to its linkage with large protein molecules. It is likely that the major fraction of serum cholesterol fails to enter the arterial intima for the same reason. The fraction that does enter the intima is probably united to relatively small protein molecules or entirely dissociated from protein. Moreton (3) and Gofman et al. (4) have claimed that serum lipids may exist in aggregates of varying particulate size. It is possible, therefore, that the smaller particles of lipid in the serum are

able to enter the intima, whereas the larger ones are rejected.

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### Mango Grafting in Eight Weeks

#### L. B. Singh

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Fruit Research Station, Sabaranpur, U. P., India

Mango is commercially propagated by inarching. Age of the seedlings to be i arched varies from 11/2 to 21/2 years, and the grafts are separated from the parent tree in about 3 months. Thus, it takes 2-3 years before a mango graft is ready for transplanting in the field. During this period, the nurseryman must take very good care of the seed ings; brsides, copious watering of grafts, essential for good union, makes the method cumbersome and expensive. Further, such grafts, being on 2-year-old seed ings, have a relatively poor root system. They also do not transport well.

Inarching of mangoes on 4-week-old seedlings was, therefore, tried by the author in order to overcome the serious disadvantages mentioned. Mango stones planted in the the first week of July started germinating by the end of the month. About 30 days after germination, the seedlings attained a height of approximately 1 ft and a girth of 1/8 in.-1/4 in. One hundred such seedlings were lifted from the seedbed along with stones and sprouting roots, and the soil



Fig. 1.

clinging to the stones was removed. The stones were then covered with wet sphagnum moss about 1/2 in. in thickness, held in position by a thin string. The seedlings were taken to the parent tree and inarched with new shoots of equal thickness in early September

Complete union took place in about a month, and the grafts were detached from the mother plant by the end of September and potted. Eighty per cent success was obtained. Watering was completely withheld since the entire operation was completed in the rainy season, when the rain water absorbed by the moss furnished the required moisture. This method also obviated the necessity of lifting of stock with a ball of soil for food material, as this was supplied by the stones.

### Temperature-dependent Characteristics of an Adenylpyrophosphatase Preparation from Potatoes1

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A need for a means of selectively hydrolyzing the acid-labile phosphate groups in ATP arose in our studies (1) on the turnover of labeled phosphate in the ATP present in preparations from animal tissues. Although crystalline myosin (2) and purified myokinase (3) proved useful, the time and effort involved in the preparation of these enzymes, together with the lack of stability of myosin, prompted a study of other preparations (4) that might be both stable and easily available. We report here on a preparation from potatoes which, in suitable dilution, possesses the desirable property that at temperatures above 7° C it catalyzes the hydrolysis of the 2 acid-labile phosphates in ATP, and at 7° or below it catalyzes the hydrolysis of only the terminal group. The preparation is quite stable and may be prepared in a period of 24 hr. One sample, saturated with toluene, maintained its activity over a period of a year. Between periods when aliquots were withdrawn for use in the analysis of ATP, the solution was stored at 2°-5° The usefulness of our preparation in the large-scale conversion of ATP to ADP is being studied.

Kalckar (5) and, later, Krishnan (6) reported on an enzyme preparation from potatoes catalyzing the hydrolysis of the acid-labile phosphates in ATP. Kalckar (5) suggested that a single enzyme was involved. Meyerhof (7) proposed that the name apyrase be reserved for the dephosphorylating enzymes that do not distinguish between ATP and ADP. Our preparation differs sufficiently from those reported by Kalckar and Krishnan to suppose that we are dealing with a different enzyme or a mixture of enzymes.

<sup>1</sup> This investigation was supported by a research grant from the National Advisory Heart Council, National Institutes of Health, USPHS. Accordingly, it is not appropriate to attempt any elassification at this time.

The enzyme is prepared in the following manner. Fresh potatoes<sup>2</sup> are ground in a Waring Blendor at 2° with one fifth their weight of water, and the mixture is passed through cheesecloth. The filtrate is permitted to stand at 2° to allow settling of the starch and the cell debris. The colored supernatant is decanted and the pH adjusted to 3.75 with 10% acetic acid at 0°. The supernatant from the acid precipitation is obtained by centrifugation and dialyzed against distilled water at 2° until free of chloride and phosphate. The slight amount of protein that precipitates during dialysis is removed by centrifugation.

The resulting supernatant is a clear, all but colorless solution showing an activity of 7,000-11,000 units/ mg protein when tested under conditions of substrate excess according to the standard test of Krishnan (6). The preparation catalyzes the complete hydrolysis of the 2 acid-labile phosphates in ATP and shows negligible activity toward adenosine-5-phosphate and inorganic pyrophosphate. Like the preparations of Kalckar and Krishnan, it is activated by calcium ion. The activity of our preparation toward other phosphate esters can be judged, at this time, only by the result of several trials in which it was used to estimate the ATP content of preparations of rat brain homogenate (8). The values calculated for the ATP content agreed with those obtained by the use of erystalline myosin and differed markedly from those obtained by the use of 10-min acid hydrolysis. It would appear from these results that the preparation does not show marked activity toward the other phosphate esters present in an active rat brain prepara-

The results of preliminary studies of the kinetics of the hydrolysis of ATP as catalyzed by our enzyme preparation are given in Fig. 1. The time-dependent

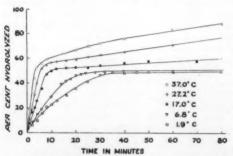


Fig. 1. The hydrolysis of the acid-labile phosphate in ATP.

course of the hydrolysis was established by determining the inorganic phosphate liberated at intervals throughout periods of 60 or 180 min, depending upon the temperature. As shown in Fig. 1, studies were conducted at 37.0°, 27.2°, 17.0°, 6.8°, and 1.9°. The

<sup>2</sup> White-skinned and red-skinned potatoes and yams, obtained from retail outlets, were used.

procedure of Fiske and Subbarow (9) was used for the determination of phosphate. Each ml of the digestion mixture that was employed contained 0.5 mg calcium chloride, 0.5 ml M/10 succinate buffer pH 6.5, ATP equivalent to 48 µg acid-labile phosphorus, and 100 units of the enzyme. A solution of ATP and a solution containing the remaining components of the digestion mixture were equilibrated to the temperature of the bath and mixed at zero time. Aliquots were withdrawn at intervals and pipetted immediately into the acid molybdate reagent of Fiske and Subbarow. A control flask without enzyme served as a blank. A similar study, not reported in detail, was made wherein approximately equimolar amounts of purified ADP served as substrate.

The curves for the data obtained at 37.0°, 27.2°. and 17.0° show that inorganic phosphate is liberated in two steps, one much faster than the other, and indicate that the enzyme preparation is many times more active toward the terminal group (P3) in ATP than toward the terminal group (P2) in ADP. The data available are sufficient to afford an estimate of the respective rates. At the temperatures 37.0° and 27.2°, for example, the phosphate attributable to P<sub>2</sub> is liberated according to the first-order law, with little deviation except near the completion of the reaction. The constants for the hydrolysis of P2 when ATP served as the substrate are:  $K_{37} = 0.018 \text{ min}^{-1}$  and  $K_{27} = 0.011 \text{ min}^{-1}$ ; when ADP served as the substrate,  $K_{37} = 0.017 \text{ min}^{-1} \text{ and } K_{27} = 0.012 \text{ min}^{-1}$ . An approximation of the constants for the hydrolysis of P3 at the same temperatures yielded value thirty times greater than those calculated for the hydrolysis of P2.

The curves for the data at 6.8° and 1.9° show that the hydrolysis stops sharply when 50% of the acidlabile phosphate has been made free and suggest that the liberated phosphate represents the exclusive and complete hydrolysis of P3. Support for this suggestion is offered by the observation that, under the conditions of these experiments, several samples of the enzyme preparation showed only negligible activity toward ADP over periods of 90 min. In conformity with these observations, calculations according to the Arrhenius equation, using the constants for the hydrolysis of  $P_2$  at 37.0°, 27.2°, and 17.0°, when either ATP (second stage of hydrolysis) or ADP served as substrate, suggest that the energy of activation increases as the temperature is lowered. Quite possibly, due to reversible inhibition (10) of the enzyme or other factors, very high values for the energy of activation are reached at temperatures near 7°. Studies in progress are directed toward a more complete understanding of the kinetics, the temperature characteristics, and other properties of this enzyme preparation.

The thirtyfold difference in the values for the hydrolysis constants for P. and P<sub>2</sub>, in comparison to the approximately twofold differences reported by Kalckar (5) and Krishnan (11), suggest that we are not dealing with the same enzyme preparation reported by them. This difference raises the question

whether potato "apyrase" is a mixture of ATPase and ADPase, the ratio of which in any given preparation depends upon the procedure employed.

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### Nudibranch Spicules Made of Amorphous Calcium Carbonate<sup>1</sup>

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The occurrence of amorphous calcium carbonate in nature has rarely been proved. The principal known case is that of the calcium carbonate in some arthropod exoskeletons. Mayer and Weineck (1) demonstrated by x-ray diffraction that the exoskeletons of Astacus and Julus contained amorphous calcium car-

A second interesting case is that of the spicules in the tissues of the nudibranch mollusks. Fifty per cent of the dry tissue is made up of calcium carbonate spicules about .5 mm long. The mineralogical form of these spicules has been in dispute. Schmidt (2), using optical methods and specific gravity measurements, concluded that they were vaterite. But Rinné (3) found no x-ray diffraction pattern and concluded that the spicules were amorphous. Mayer and Weineck (1), on the other hand, found an x-ray diffraction pattern characteristic of vaterite. Their specimens had been preserved in 70% alcohol.

In the present study three careful attempts were made to obtain an x-ray diffraction pattern of the spicules in the dried tissue of Archidoris.2 Only a faint halite pattern was obtained from the few halite crystals visibly scattered among the preponderance of calcium carbonate spicules in the dried tissues as teased under a microscope. After ashing, the x-ray diffraction powder pattern consisted of a strong calcite pattern and the same weak halite pattern. These studies are a confirmation of the presence of amorphous calcium carbonate in the spicules of the nudibranch Archidoris. It seems likely that the vaterite

<sup>1</sup> From a dissertation on The Biogeochemistry of Strontium, presented to the faculty of Yale University in partial fulfillment of requirements for the Ph.D. degree. Grateful appreciation is expressed to G. E. Hutchinson for his direction and to Horace Winchell, of the Brush Mineralogical Laboratory, Yale

University, for use of x-ray facilities.

2 Obtained by G. E. Hutchinson and H. W. Harvey from Plymouth, Eng.

may occur as a transformation product resulting from conditions of preservation. The submicroscopic morphology of these amorphous but birefringent spicules is an unsolved colloid problem.

In the case of these spicules, as in the cases of other biological skeletons, a consideration of three levels of integration is required. Molecular patterns alone do not yield a complete description, for the arrangement of the molecular units at colloidal and microscopic levels is also a major aspect.

In their gross form the spicules of Archidoris resemble the calcite spicules of some octocorals and the opal spicules of some sponges. It was Schmidt (2) who generalized that organisms often build similar skeletons out of entirely different chemical substances.

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### The Heparinoid Nature of a Serum Mucoprotein<sup>1</sup>

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A possible role of the serum mucoprotein fraction in blood coagulation mechanisms was suggested by its acidic properties and high polysaccharide contentcharacteristics common to heparin and to synthetic sulfonated polysaccharide esters (1) with anticoagulant activity. Increase in the polysaccharide/protein ratio and reduction of the protein component within

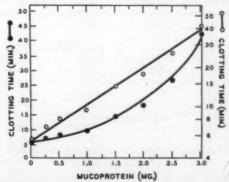


Fig. 1. Influence of mucoprotein concentration on the whole blood congulation time (Lee-White) of 0.9 ml of fresh human blood. Fresh blood was added to 0.1-ml aliquots of an ox mucoprotein solution prepared in M/3 phosphate buffer (pH

preliminary report. These studies were initially presented at the Conference on Folic Acid Antagonists in Neo-plasia, March 11, 1951, The Children's Hospital, Boston, Mags. 2 With the technical assistance of J. Dolores Johnson

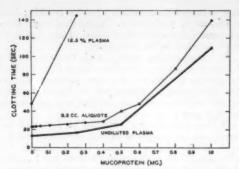


Fig. 2. Relationship of mucoprotein concentrations to the clotting time of recaleified normal human plasma. The wide lower line shows the results of addition of 0.1-ml aliquots of ox mucoprotein in M/5 phosphate buffer to 0.1 ml of human plasma clotted by the Quick method. The clotting times observed with 0.2-ml aliquots of mucoprotein, plasma, and thromboplastin, as well as the effect of 0.1-ml aliquots of mucoprotein on the clotting of 12.5% plasma (Shapiro-Link method), are indicated by the thin lines above.

the serum mucoprotein fraction were recently observed (2) in patients with either uncomplicated hepatic insufficiency (hepatitis, portal cirrhosis) or discases characterized by abnormal globulin formation (multiple myeloma, kala-azar, etc.).

Mucoproteins were isolated from dog, ox, and human serum by two methods: (a) ammonium sulphate (3) precipitation followed by dialysis; (b) precipitation (3) with phosphotungstic acid. Both methods employ precipitation with perchloric acid for the initial exclusion of the serum albumins and globulins. Mucoprotein fractions isolated by method (a) showed no anticoagulant activity. A clot-decelerating action on whole blood (Fig. 1) and recalcified plasma (Fig. 2) was observed with buffered solutions of mucoproteins obtained from the three species by method (b). Precipitation of pepsin, protamine, or human serum albumin with phosphotungstic acid did

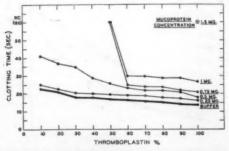


Fig. 3. Effect of mucoprotein on the activity of thromboplastia. Illustrated are the clotting times of plasmas in which 0.1-ml aliquots of various concentrations of thromboplastin (Difco) were added to 0.1-ml samples of an ox mucoprotein prior to recalcification. The results with the buffer control (M/10 barbital) are shown in the lower wide line; the increasing concentrations of mucoprotein fom 0.25 to 1.5 ml are shown in ascending order. Incubation of mucoprotein with the thromboplastin for 5 min according to Tocantins' method showed no evidence of a direct antithromboplastic action. N. C. (60) = no clot at 60 sec.

not yield proteins with anticoagulant activity, although similar treatment of several polysacchariderich globulin fractions (IV-4, IV-6, and IV-7 of Cohn) resulted in complexes with a clot-retarding activity approaching that of the mucoprotein.

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Optimum clot-deceleration of mucoprotein solutions occurred at pH range 62 to 7.5 in phosphate, barbital, borate, or imidazole buffers. Solutions were stable on standing for 24 hr and were not inactivated by heat of 65° C for 20 min. The approximate anticoagulant activity of several mucoproteins on whole blood was 1/50 to 1/150 that obtainable with a commercially available heparin (Abbott). The activity of isolated thromboplastin (4), thrombin (5), or fibrinogen (5) was not inhibited by direct addition of mucoprotein. However, the clot-decelerating effect of mucoprotein on plasma could be easily prevented by the addition of an excess of either thromboplastin (Fig. 3) or, to a lesser extent, of thrombin. Mucoproteins produced a metachromatic reaction with toluidine blue. Complex-formation or binding of an ox mucoprotein by protamine solutions blocked the deceleration of whole blood clotting time (Fig. 4) and of pro-

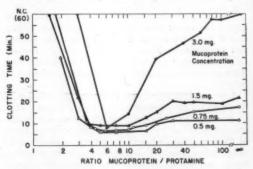


Fig. 4. Mucoprotein-protamine titrations on the clotting time of fresh whole blood; 0.1-ml aliquots of protamine (Lilly) and an ox mucoprotein (M/10) barbital buffer, pH 7.4) were placed in Lee-White clotting tube. After 5 min incubation, at 28° C, 1 ml of fresh human blood was added. The timing was started when blood was added to the first tube. N. C. (60) = no clot at 60 min.

thrombin time. The optimal ratio for binding was 4 to 10 parts of mucoprotein to 1 part of protamine (Lilly). The addition of 1.5 mg of mucoprotein increased the protamine titration (6,7), performed by the Allen (8) technique, in a representative experiment, from 80 to 120 µg. A definite relationship between protamine binding and the mucoprotein levels of sera from normal or abnormal subjects could not be established by means of either the protamine titration (Allen) on heparinized whole blood, or the binding capacity of fresh unheparinized whole blood (measured by the excess of protamine, which, in the uncombined state, inhibits clot formation). However, all sera in which increased protamine binding was observed also manifested an elevated mucoprotein level. Since the serum mucoprotein fraction obtained by method (b) combines with protamine or toluidine blue, fails to influence certain isolated components of the clotting mechanism, and acts principally on the first phase of coagulation, its relatively weak anticoagulant action may be termed "heparinoid" in nature. The relationship of various methods of isolation to anticoagulant property will be reported elsewhere (9). No correlation of the serum mucoprotein level with certain hemorrhagic syndromes reported to be associated with the presence of heparinlike substances (10, 11) in the serum has thus far been observed.

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### The Percutaneous Absorption of Water Vapor1

### C. W. DeLong<sup>2</sup>

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e 4 Health Instrument Biology Division, General Electric Co.pany, Richland, Washington

A recent paper by Szczesniak, Sherman, and Harris (1) described an experiment which demonstrated the percutaneous absorption of water by rats immersed in 40% deuterium oxide solution. This prompts us to report some observations we have made on the percutaneous absorption of water vapor, using tritium oxide as a tracer. Although there have been many studies and some controversy over the percutaneous absorption of water from the liquid state (reviewed by Szczesniak et al. [1]), there has not, to our knowledge, been any attempt to demonstrate such absorption of water vapor.

Our experimental procedure involved the exposure of a shaved area of the abdominal skin of 300- to 400-g rats to an atmosphere of tritium-labeled water vapor. The animals were under Nembutal anesthesia, and exposures were in most cases of 1 hr duration.

The exposure chamber consisted of the female member of a glass ball-and-socket type ground joint with a cross-sectional area at the open end of 6.6 cm2. A small cup to hold the aqueous solution of tritium oxide was suspended in the chamber, and the open end of the exposure chamber was held against the rat skin by slight pressure. In some of the initial exposures the chamber was sealed to the skin with collodion, but later this precaution was found to be unnecessary.

<sup>1</sup>Bused on work performed under Contract No. W-31-109-Eng-52 for the Atomic Energy Commission.

Thanks are due R. C. Thompson for his cooperation and suggestions, and R. C. Thorburn for radioanalysis of the many samples required.

TABLE 1

PERCUTANEOUS ABSORPTION OF WATER VAPOR BY THE RAT FROM A SATURATED ATMOSPHERE AT 30° C

Method of sampling	Total No. exposures	μg water/cm <sup>2</sup> skin/min
Immediate blood sample	66	2.5 ± 1.3
24-hr blood sample	23	$4.2 \pm 1.2$
Total body water sample	49	$3.0 \pm 1.5$

The liquid in the cup does not come in contact with the skin but serves as a reservoir for the maintenance of an atmosphere saturated with water vapor.

The amount of water entering the animal was determined by radiometric analysis for tritium in either: (a) a blood sample withdrawn from the heart immediately following exposures, (b) a blood sample taken approximately 18-24 hr after the exposure, or (c) a sample of the body water obtained by azeotropic distillation of the ground animal with benzene. Analyticul results obtained on the 24-hr blood samples were corrected for the biological half-life of tritium oxide in the rat, which time has been determined to be approximately 3 days. Details of the procedure used in the radioanalysis of samples and in determination of the biological half-life will be reported elsewhere.

About two thirds of the data were obtained from single exposures. The rest were obtained from experiments in which animals were exposed repeatedly at 24-hr intervals, the amount absorbed in a single exposure being determined by the difference in activity between pre-exposure and post-exposure blood samples. The variation between different exposures of a given animal was as large as that between exposures of different animals. The statistically summarized results are given in Table 1. It is obvious that complete equilibration of the absorbed water vapor with the body water did not occur until after the immediate post-exposure blcod sample was taken. It has been shown previously that subcutaneously injected water in the human does not become equilibrated with the body fluids for a matter of several hours (2).

Considering the absorption/cm2/min to be 4 µg, and taking 500 cm2 as the total surface area of a 350-g rat (3), then 2,000 ug of water is absorbed by the rat per minute from an atmosphere saturated with water vapor. This is an interesting quantity compared with the water intake via the lungs which, assuming an air intake of 60 ml/min, would absorb 2,000 µg/min from the same atmosphere. The calculations for all data involving micrograms of water penetrating the skin were made with the assumption that tritium acts like hydrogen, even though this is probably not strictly true.

The effect of varying water vapor pressure and the extent of absorption in other animals are being investigated and will be reported in detail later.

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### Comments and Communications

### Ascorbic Acid in Tea

AN ASSOCIATED PRESS dispatch, dated April 29, 1951, from Moscow, stated that "researches of the Bakh Institute of Biochemistry have conclusively proved that the tannin of tea leaves is equivalent to Vitamin C in citrus fruits."

It may be of interest to scientific readers to recall the fact that in 1935 Henry Tauber and I reported (J. Biol. Chem., 110, 559) that tea contains 0.22 mg of true ascorbic acid per gram of substance. This is about half to one third as much as is present in citrus fruit juices, and "the amount avai able from a nutritional standpoint is much less, because of the actual amount used in infusions and hence consumed."

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### A Basic Feature of the Chambers' Micromanipulator

An article by M. J. Kopac (1) gave the impression that there is an error in the basic construction of the Chambers' micromanipulator. The modification Kopac introduced is to replace the upright post of the Chambers' instrument with the main body of a standard B & L microscope. This has the excellent feature of introducing a long-range control, both coarse and fine, for the vertical movements. Such a device was indeed tried in one of the earlier Chambers' models, but it was discarded because the stability of the fine horizontal movements would thereupon be dependent on the firmness of the coarse adjustment mechanism of the microscope part. This presented the possibility that wear and tear over a period of time might loosen the adjustment and hence vitiate the efficiency of the fine horizontal adjusting mechanism of the micromanipulator.

The criticism made was that the up-and-down fine movement of the Chambers' instrument, being in an are, "produces an appreciable lateral displacement of the microtip [of the needle] a'ong with the vertical motion." The possibility of such a displacement was very much on my mind at the time the instrument was first devised and would have condemned using the principle of are movements unless such a possibility could be circumvented. It was circumvented successfully, so that the principle of are movements produced by the spreading apart of rigid bars against the springs was finally decided upon as the most practical, efficient, and economical way for securing stable fine movements. Moreover, the construction involves an absolute minimum of frictional surfaces. As a result, instruments constructed by E. Leitz on this arc-movement principle for all three fine movements have been in constant use and are still serviceable after more than 30 years.

The displacement, regarded as a criticism of the construction, is eliminated provided the micromanipulator is properly mounted with reference to the height of the moist chamber on the stage of the microscope. In the field of the microscope the straightness of travel of the microtips, although they move along area of circles, is due to the minuteness of the are (<2-3 mm) of a 3-in. circle along which the microtip moves. In order to ensure the horizontal movements traveling at right angles to one another, the manipulator has to be put in a proper position with respect to the microscope.

In the present statement, attention is restricted to the mechanism for the up-and-down movement. Fig. 1

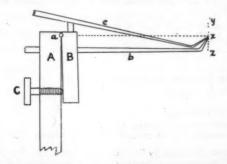


Fig. 1. Diagram of part of Chambers' micromanipulator illustrating the up-and-down moving mechanism. A represents the vertical rigid post; B is the vertically placed bar, spring-hinged at a so that tu.ning the screw C will induce an up-and-down movement of the microtip at x along the most vertical part of the arc y-x. It is immaterial where the shaft of the needle is placed—e.g., either b or c, provided the shaft is mounted somewhere on B and the microtip is at a.

is a diagram in which the height of the post A is properly adjusted as follows: The pivot, or center of rotation, of the spring bar at a must be at a height level with the roof of the moist chamber on the stage of the microscope. This will cause the tip of the microneedle, when touching the undersurface of the cover-slip roofing the operating moist chamber, to be about on the level of a dotted horizontal line, x, projected from the pivot and over the microscopic stage. In such a position the microtip will travel along the most vertical part of the arc, y-z, irrespective of the position of its shaft—e.g., either b or c.

The fault of the Chambers' model lies in the lack of adequate control of the coarse adjustments. These adjustments are serviceable chiefly for bringing the tips of the microneedles and pipettes into the field of the microscope. For actual operation only the fine adjustments are to be used. It is to be hoped that Kopac's modification will take care of the coarse vertical adjustment that is sorely needed in the mounting of the microtip in the vertical position. As long as the firmness of the introduced vertical control mechanism is

maintained, this introduces a much-needed long-range coarse adjustment.

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New York University

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### Information Wanted

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I am preparing a biography of Richard Everingham Scammon, who was professor of anatomy at the University of Minnesota from 1914 to 1930, and distinguished service professor, Graduate Faculty, since 1935. Dr. Scammon is now retired and living at Branson, Mo.

I would appreciate your bringing this project to the attention of your readers, some of whom may have interesting and valuable stories, aneedotes, letters, or other reminiscences pertaining to him. All correspondence in the original will be carefully preserved and returned to the owner. I would request that all communications be sent directly to me.

HARRY A. WILMER

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### Language Problems in Science

DISCUSSIONS about language problems in English and American journals are always a source of mild amusement to those of us who belong to the smaller languages. Mice must have a similar feeling if they can hear the elephants discussing the disadvantages of being small!

Generally, a scientist from one of the smaller languages must possess a working knowledge of—besides his own—the three main languages, English, French, German. The designation "main languages" does not refer to the number of people using them as their mother tongue, nor to the actual number of pages of science being published in the various languages tod..y. It simply reflects the fact that the relevant literature has been published in these three languages. This is a fact that cannot be debated, whether we like it or not.

The need to learn three foreign languages (and generally to learn at least one of them thoroughly) imposes a not-inconsiderable extra intellectual burden, even if these languages are rather closely related. Do the proponents of Esperanto (or any other "syn'hetic" language) realize that the introduction of this language as a means of scientific communication would mean that we shall have to learn a fourth language (admittedly somewhat easier than the rest)? Even if by universal agreement, starting tomorrow, Esperanto should be the only language to be used in scientific publications, there would still be the old literature (very important in many branches of science) which would necessitate forever the learning of other languages, and in many cases a spot of Latin besides.

There is another point glibly overlooked by the proponents of Esperanto—viz., that it is very far from being universal in structure. Esperanto is an Aryan language—west Aryan, to be more specific—and to non-Aryans it is just as difficult to learn as the much more useful living languages.

Under special circumstances many considerations may justify the publication of scientific material in a small language; but speaking as a member of a very small nation myself, I completely agree (in matter, though perhaps not in form) with the denunciations that have appeared in SCIENCE of all tendencies toward linguistic isolationism. Scientific studies are pursued all over the world by people speaking no end of languages, and I have no more right to demand that my colleagues shall learn Norwegian to study what I may produce, than anybody else has the right to demand that we shall all learn Burmese. We cannot demand that the scientific world shall take notice of a publication when we ourselves do nothing to make this possible. If we cannot write the other language ourselves and cannot afford a complete translation, simple consideration should prompt us to give at least a summary. (But the art of making summaries is no easy one!)

Linguistic isolationism is no monopoly of the small languages. In the great ones it takes the less obnoxious form of neglecting all literature of other languages and of not bothering to learn even two foreign ones sufficiently well to use them. This is generally a detriment to the individual only, whereas the loss of an important publication in a small language will generally be a detriment to science as a whole.

Lincicome maintains (SCIENCE, 113, 607 [1951]) that, "if allowed to use their national tongue, many writers will publish much of scientific value that wou'd remain unpublished (and therefore totally inaccessible) if it had to be translated." Is Lincicome prepared to learn Burmese to gain access to this literature? I am not, and I doubt if any Burmese colleague would be prepared to learn Norwegian. Abstracting journals do a great job, but have we any right to load the burden of translation upon the shoulders of our colleagues?

However much sympathy one might have for nationalism, linguistic isolationism is inconsiderate and constitutes, I think, one of the sins that cannot be forgiven in human society.

KNUT FAEGRI

University of Bergen, Bergen, Norway

Having spent two months in Japan I have had my attention greatly sharpened as to communication. I've just caught up with the exchange of letters between H. David Hammond, D. R. Lincicome, and Ancel Keys. I take it as obvious that language is being used for chauvinistic purposes in many places, and am convinced that both language and science are being used for such purposes wherever the USSR is in political control.

However, the real questions about scientific writing

are: (a) to whom am I talking? and (b) how can I reach his cars (eyes)? It is shortsighted for one to write in a language of narrow currency. A scientist who is convinced of the importance of his communication for science (which we take to be world-wide) will, if he is wise and free, put it in that language which will best carry his thoughts to the most people who will be interested in them. It is a question of what language gives the maximum value to the product of the following factors: author's facility in the chosen language × author's willingness × readers' facility × readers' willingness × number of prospective readers. The values of facility and willingness would be on a

scale of zero to unity. One can expect author's willingness to be high and readers' willingness low. I daresay this would nearly always result in choosing English.

If however, the author is interested not in communicating with the scientific world, but in achieving fame among those who have security or profit to bestow, then he will limit correspondingly the universe of application of the three reader factors. This will usually result in his choosing his own national language.

R. R. NEWELL

Stanford University School of Medicine San Francisco, California

### Book Reviews

Culture Worlds. Richard Joel Russell and Fred Bowerman Kniffen. New York: Macmillan, 1951. 620 pp. \$6.00.

Culture Worlds is designed as a regional, world text for beginning students in geography. The cultural approach is used, according to the authors, as a logical method of providing a sound, unified geographic background for studies in the social sciences and other fields in contrast to the common practice of presenting a semester of physical geography followed by one in

regional geography.

The authors divide the earth into 7 culture worlds, "occupied by peoples who are strikingly alien to inhabitants of other culture worlds," which are subdivided into culture realms, smaller culture regions, and zones of transition between culture worlds. The culture worlds are: "Polar World," with Eurasian a d American realms; "European World," with Northwestern, Eastern, and Mediterranean realms and a western transition zone of France and Switzerland and French Barbary in Africa; "Dry World," with the Arab-Berber and Turko-Mongolian realms of Africa and Asia; "African World," treated on the basis of Herskovits' 5 culture areas to which is added a sixth, Madagascar; "Oriental World," with the Indian, Chinese (including Japan), and Malayan realms and the Indo-Chinese transition zone; "Pacific World," with Polynesian, Micronesian, Melanesian, and Australian (including New Zealand) realms; and "American World," including the Anglo-American and Latin-American realms. The expansion and impress of the European world on the other culture worlds are characterized as the "New World Revolution," whose effects on the other culture worlds are treated in detail in the individual sections.

The text is replete with information that will be of interest to people in many disciplines. Individual culture traits of each culture world are given intensive analysis from the standpoint of the social and economic patterns that have evolved. Much background

material is included on racial and political antecedents of the present culture worlds and on recent political events, such as postwar territorial changes and creation of new states. Although the focus is primarily on cultural features, there is detailed discussion of the physical environments and explanation of physical processes and terms.

Mention should be made of the excellent illustrative material: 181 graphic maps and diagrams, 51 illustrations, 30 tables, and end-plate maps of the culture worlds.

Russell and Kniffen offer the reader much of interest in specific information, ideas of development of cultures and movement of peoples, and a method of treatment of the complex subject of cultural geography. Individual differences of opinion may arise regarding the authors' selection of specific culture worlds and the use of a regional, cultural approach as an introductory study of geography without a preliminary systematic discussion of cultural geography.

HUEY LOUIS KOSTANICK

Department of Geography University of California, Los Angeles

Nutrition and Chemical Growth in Childhood: Calculated Data, Vol. III. Icie G. Macy. Springfield, Ill.: Thomas, 1951. Pp. 1463-2174. \$8.00.

This new volume contains all the data that can be calculated from the great mass of chemical analyses of food, urine, and feces already published in Volumes I and II. The book consists entirely of tables presenting for each child studied in the first two volumes such "calculated data" as average daily absorption and retention, percentage of intake absorbed and retained, absorption and retention per kilo of body weight, per centimeter of body length, and per square meter of body surface. These calculations are given for energy, fat, nitrogen, phosphorus, chloride, sulfur, negative minerals, calcium, magnesium, sodium, potassium, positive minerals, and excess of either positive or

negative minerals. At the close of each section, averages for all the individuals studied are given in relation to body weight, length, and surface area. An appendix supplies an interpretation of each of the roentgenograms of the hands and wrists reproduced in Volume II. Tables for each child give the age of each of these bones in relation to the child's chrono-

logic age.

This volume rounds out the series on interpretations where only a small number of the figures obtained could be included. By the use of many scales, it attempts to evaluate the processes of normal growth and development. Examination of the tables reveals the great variations in metabolism, not only in relation to age and sex but among comparable individuals, and in the same individual during rather closely spaced periods of study. The tables show that growth does not take place in a smooth, linear fashion but consists of a series of spurts with an occasional period of regression. Hence, it emphasizes once again the need of long-term studies in this field. The book should be of great interest to all those engaged in the study of growth and metabolism in childhood.

SELMA E. SNYDERMAN

Department of Pediatrics New York University College of Medicine

 Handbook of Human Engineering Data for Design Engineers. Techn. Rept. No. SDC 199-1-1, NavExos P-643, Special Devices Center (U. S. Navy). Medford, Mass.: Tufts College, 1949, 1951. Approx. 500 pp. \$6.75.

This is the first systematic handbook of human engineering. In tables, graphs, and highly condensed discussion, it summarizes the available information on the characteristics of man that can help the engineer designing new equipment to realize the full potential of that equipment. The necessity of having such a book is given in a foreword by Admiral de Florez:

We have now reached the point where the machine has dwarfed the man, for the characteristics of the individual—the human machine—have not changed in the memory of man and will not change for countless generations to come, while the man-made engine is capable of ever increasing power, scope, and speed of operation. . . The human faculties of perception, action, reaction, and decision can now be taxed to such an extent that it is no longer possible to take full advantage of the machine unless the controls of the machine can be tailored to human capabilities . . . consequently the average man's capabilities must be analyzed, measured, and made available to the designer and engineer to make good our progress from now on.

The handbook makes available to design engineers those of man's capabilities that have been analyzed and measured. The four chapters on "Motor Responses" will illustrate the coverage and type of content. The first chapter gives an introductory discussion of basic concepts; the second and third cover reaction

time; effect of sense used upon reaction time; effect of intensity of stimulus upon reaction time; individual variability in reaction time; factors affecting speed of movement; exertion of force; muscular aspects of steadiness; characteristics of rhythm, work, and efficiency; effect of work upon efficiency of other work; factors of the stimulus that influence control movements; efficiency of one- and two-handed work; effect of incentives on performance; and a number of similar topics. The data are presented in four graphs, 25 quantitative tables, and a number of qualitative "tables" giving data not yet, at least, in quantitative form. The concluding chapter gives a brief summary of the principles of motion economy.

Bibliographies to guide the reader to the original sources are scattered throughout the book. There are eight, for example, in the chapters on "Motor Responses." There is a detailed subject index, a separate

author index, and a glossary.

Psychologists and others interested in man's capacities will find the book gives easy access to a great deal of hitherto scattered material. The Technical Publications Division of the engineering firm of Jackson and Moreland has seen to it that the data are presented in

a form useful to engineers.

In 1949, an initial edition of 500 copies was distributed to a group of critics. Corrections, additional chapters, and revised indexes and glossary were distributed in 1951. With these changes the book has now become available in a second edition for general distribution. The physical design facilitates future changes and additions, for the chapters are separately paginated and the individual sheets can be removed and replaced. Titles of the nine parts already available are: "The Human Machine," "The Human Body," "Vision," "Audition," "Skin Sensitivity and Proprio-ception," "Motor Responses," "Physiological Conditions as Determinants of Efficiency," "Intelligence," and "Learning." There will undoubtedly be additional chapters and changes in these in the future, for there is much information that should have been included but for which satisfactory data do not yet exist. No one is more aware of these gaps than are the authors, who have combed anthropological and physiological literature as well as psychological sources for the extensive information they do present.

John Kennedy and his colleagues at Tufts College, with the assistance of the Special Devices Center and the firm of Jackson and Moreland, have produced a book of high merit for its content. But even more noteworthy is their demonstration that the time has arrived when it is worth while to begin to do for physiological and experimental psychology what the Handbook of Chemistry and Physics has long done

for its subject fields.

DAEL WOLFLE

Commission on Human Resources and Advanced Training Washington, D. C.

### News and Notes

### Scientists in the News

Domenico Antonio Adovasio, of the Free Territory of Trieste, has been named a fellow in thoracic and cardiovascular surgery at George Washington University School of Medicine, to work under the supervision of Brian Blades. He is one of the first three students from Trieste to be assigned to study in the U. S. under the Smith-Mundt Act.

Arthur C. Bachmeyer, of the University of Chicago Division of Biological Sciences, became professor emeritus on Oct. 1. The only educator to hold the three presidencies of the American Association of Medical Colleges (1951), the American College of Hospital Administrators (1940), and the American Hospital Association (1923), Dr. Bachmeyer will remain as consultant on the extensive hospital construction now under way on the Midway campus.

Pearce Bailey has been appointed first director of the National Institute of Neurological Diseases and Blindness (USPHS), which was established last summer. Dr. Bailey has been chief of the VA Section on Neurology, assistant chief of the Psychiatry and Neurology Division, and professor of clinical neurology at Georgetown University.

Marjorie T. Bingham has left the Biology Department of Northern Michigan College of Education to become head of the Biology Department of Centenary Junior College, Hackettstown, N. J.

Trevor H. Clark, formerly with Federal Telecommunications Laboratories (IT&T), has been appointed director of the Division of Military Research and Development at Southwest Research Institute. Dr. Clark has recently returned from Brazil and Argentiva, where he acted as adviser in the establishment of new television stations.

Cora DuBois, anthropologist and authority on Southeast Asia, has been appointed director of a new research program which the Institute of International Education, Washington, D. C., will carry out in an effort to determine educational needs and resources of the world's underdeveloped areas.

William C. Geer, of Ithaca, N. Y., inventor of the vulcanized cover for golf balls and the rubber de-icer "overshoe" for airplanes, received the Charles Goodyear Medal for outstanding achievements in the chemistry of rubber at a dinner of the American Chemical Society's Division of Rubber Chemistry, as part of the diamond jubilee meeting. Cornell University recently honored Dr. Geer by establishing the William C. Geer Laboratory of Rubber and Plastics (SCIENCE, 114, 313 [1951]).

Jos-ph A. Groesbeck, assistant librarian for acquisitions, will leave the Army Medical Library to accept

the position of chief of the Processing Division of the United Nations Library, New York City. Clo

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Wilton L. Halverson is heading a special joint survey to evaluate the health and sanitation programs of 17 Central and South American countries. He has been given a six months' leave of absence from his position as director of public health of the California State Health Department to head the survey, which is being carried on under the supervision of USPHS and under the direction of Ass.stant Surgeon General Joseph Mountin, associate director of the Bureau of State Services, USPHS, and H. van Zile Hyde, director of the Health and Sanitation Division of the Institute of Inter-American Affairs. Also named to the staff of the joint survey were Joan Klebba, who will serve as public he lth analyst; Richard Poston, sanitary engineer; Lar. V. Er dsher, director of the Bureau of Welfare Administration, Department of Welfare of New York City; Edna Brandt, Public Health Service nurse; and George Foster, director of the Institute of Social Anthropol gy of the Smithsonian Institution.

Norman Hardy has been elected a vice president of the Arabian American Oil Company. Prior to joining Arameo last February, Mr. Hardy, a geologist, was president of the Richmond Petroleum Corporation, a subsidiary of Standard of California. His post will be in Dhahran, Saudi Arabia, field headquarters for Arameo.

Wa'ter H Hodge, resociate professor of botany at the University of Massachusetts, has resigned to accept a position as specialist in economic botany and assistant to the head of the Division of Plant Exploration and Introduction, Bureau of Plant Industry, Beltsville, Md.

Aladar I.o'lander has been named professor emeritus of mechanical engineering, and A. W. Galston has been promoted from senior research fellow to associate professor of biology at Caltech. Professor Hellander joined the Caltech feulty in 1944. He has been chief engineer and consulting engineer of Aerojet Engineering Company. Dr. Galston recently returned from 15 months abroad under a Guggenheim Fellowship.

Arthur H. Hughes, of Trinity College, has become acting president of the institution, succeeding G. Keith Funst n, who has resigned to become president of the New Y rk Stock Exchange.

Arne V. Hunninen, of Mount Union College, has joined the staff of the University of Tennessee Medical Units as assistant professor of preventive medicine. Dr. Hunninen replaces Raymond Laird, resigned (SCIENCE, 114, 337 [1951]).

Lewis Webster Jones, president of the University of Arkansas, has been chosen fifteenth president of Rutgers University. Dr. Jones will succeed Robert C. Clothier, president of Rutgers since 1932, who announced last January his intention to retire as soon as his successor was found. He will become president emeritus.

D. John Lauer, former assistant professor of industrial medicine at the University of Cincinnati and plant physician for several firms in the Ohio city, has been appointed medical director of the Jones & Laughlin Steel Corporation. Dr. Lauer will direct and supervise the employe health program of the corporation and its medical facilities in all its plants and factorics.

C. P. Leblond, professor of anatomy at McGill University, was the recipient of the Chilean Iodine Education Bureau Research Award at the 98th convention of the American Pharmaceutical Association. The award was given to Dr. Leblond for his outstanding research in the field of iodine metabolism and the use of radiractive iodine in studies of the physiology and metabolism of the thyroid gland.

James E. McCormack has been named associate dean for graduate studies and assistant professor of medicine in the faculty of medicine at Columbia University. Appointed associate in medicine at George Washington University in 1948, he remained in that post until 1950, when he was appointed associate dean and assistant professor of medicine at the Post-Graduate Medical School of NYU. He has been on the visiting staff of Bellevue and University Hospitals.

Walter V. Macfarlane, professor of physiology in the Medical School of Queensland University, Brisbane, Australia, has arrived in the U. S. to serve one year as visiting professor in the Department of Physiology, State University of New York College of Medicine, New York City.

M. Eugene Merchant, formerly senior research physicist, The Cincinnati Milling Machine Co., has recently been promoted to the position of assistant director of research with that company.

Albert O. Rhoad has resigned as chief of the Division of Animal Industry of the Inter-American Institute of Agricultural Sciences, Turrialba, Costa Rica, to join the King Ranch, Kingsville, Texas.

John M. Robertson, Gardiner professor of chemistry at the University of Glasgow, Scotland, has been appointed Baker nonresident lecturer in chemistry for the fall term at Cornell University.

Recent visitors at the Eastern Regional Research Laboratory, of ARA's Bureau of Agricultural and Industrial Chemistry at Philadelphia, were C. F. Sharman and D. A. Coulson, Imperial Tobacco Co., Ltd., Bristol, Eng.; Saul Goldenstein, Argentina; F. Ana Maria Hoffman, Instituto de Pesquisas Tecnológicas, São Paulo; J. W. McBain, National Chemical Laboratory of India, Poona; Louis Giraud, Manago Conserves Nora a Meknes, Paris; and André Ravisy, Ecole Nationale d'Agriculture, d'Alyer, Algiers.

Joshua I. Traczy, Jr., Geologic Division, U. S. Geological Survey, has been designated chief of a field party that is undertaking a detailed geological survey of Guam, as a part of the Pacific Geologic Surveys program of the Ailitary Geology Branch. He will be assisted by David in Doan and Harold G. May. Simultaneously, Joseph W. Brookhart, Theodore Arnow, and Raymond Chum, of the Water Resources Division, are conducting a comprehensive survey of the island's water resources.

Under the auspices of the Department of State Exchange of Persols Program and the National University of Mexico, Mixwell M. Wintrobe, professor of medicine, University of Utah, recently spent several weeks in Mexico lecturing and in clinical work at the Nutrition and Cardiological Institutes.

Loren P. Woods, curator of fishes at the Chicago Natural History Museum, is collecting fishes in the Gulf of Mexico aboard the trawler Oregon, for addition to the maseum collections. Trawling will be conducted at various depths off the mouth of the Mississippi River and in the vicinity of the Yucatan shrimping grounds in the Gulf of Campeche. Deep-sea drags will be made in the waters from Cayo Arenas to Cayo Arcos and on the shelf at the edge of the Yucatan Channel. Through the courtesy of the Fish and Wildlife Service, Mr. Woods has made several other collecting trips aboard the Oregon.

### Education

Upon the occasion of the 400th anniversary of the National University of Mexico, Harlow Shapley, who was present to receive an honorary degree, also participated in the dedication of the new Leon Campbell Observatory at Puebla. Considered the best private astronomical observatory in Latin America, it is the creation of Sr. Domingo Taboada, one of the volunteer observers for Dr. Campbell, well-known executive head of the American Association of Variable Star Observers, who died last May.

A group of more than 126 West German students has arrived in the U. S. to study for nine months under the State Department's Exchange of Persons program. This brings to a total of 5,500 the number of students to arrive here. Part of the group will study industrial and labor relations at Cornell and the University of Wisconsin.

Illinois Institute of Technology announces the following appointments: Richard A. Carrigan, biochemist and professor of soils at the University of Florida, to supervisor of the analytical chemistry section, Armour Research Foundation; and Russell K. Edwards as research associate in the Chemistry Department. Fred L. Morritz has been awarded a fellowship in chemistry.

The following members of the faculty of the University of Illinois have been promoted to the rank of full professor: Geza de Takata, M. I. Grossman, J. E.

Kempf, Adolf Rostenberg, Jr., Max S. Sadove, Walter H. Theobald, and Willard Van Hazel.

Iowa State College will offer this fall for the first time a major in foreign trade and foreign service. It is designed for students who hope to use their technical training in science and agriculture in foreign posts and in the beginning will be aimed particularly at preparing students for work in Central and South American countries. Alfred P. Kehlenbeck was chairman of the committee that set up the new major.

The College of Pharmacy at the University of Michigan, oldest such college in a state university, will celebrate its 75th anniversary Oct. 24–25 with a program that will honor its first dean, Albert B. Prescott, outstanding alumni, and others who have contributed to the growth and development of the profession. Dean Prescott, who died in 1905, was president of the AAAS in 1891.

University of Minnesota Outstanding Achievement Award medals were given to 15 alumni of the university's College of Medical Sciences early this month. George N. Aagaard, dean-elect of the Southwest Medical School, presided at the ceremony at which the following were honored: Fred L. Adair, Maitland, Fla.; Raymond B. Allen, Seattle; Frank E. Burch, St. Paul; Olaf J. Hagen, Moorhead, Minn.; Arild E. Hansen, Galveston; Alma C. Haupt, New York; Herman E. Hilleboe, Albany; Pearl McIver, Washington, D. C.; James E. Perkins, New York; Edith L. Potter, Chicago; William P. Shepard, San Francisco; Albert M. Snell, Palo Alto; and Edward L. Tuohy, Duluth.

The Division of Neoplastic Diseases at Montefiore Hospital, New York, will offer a series of lectures by distinguished guest speakers one Friday a month through June 6, covering clinical and experimental topics in the field of cancer. Mark M. Ravitch, Alexander B. Gutman, Charles Huggins, Emanuel B. Schoenbach, Charles B. Ripstein, S. W. Chamberlain, Joe V. Meigs, and Arthur Purdy Stout will be among the speakers.

The School of Agriculture and Agricultural Experiment Station, North Dakota Agricultural College, announce the following staff changes: Glenn S. Smith will become chief of the Division of Plant Industry and professor of plant breeding; Arlon G. Hazen will become assistant to the director of the station; Howard M. Olson has been named superintendent of the Williston Irrigation and Dry Land Stations; George L. Pratt has been appointed acting instructor in agricultural engineering and acting assistant agricultural engineer; and E. A. Helgeson has been granted a six months' leave of absence to serve with the FAO to advise the government of Chile on the control of blackberries, which infest 1½ million hectares of land in that country.

The University of Utah College of Medicine has established a program of postgraduate medical education with the assistance of the W. K. Kellogg

Foundation. Short courses will be presented in Salt Lake City, and teaching programs in the Intermountain areas, Utah, Idaho, Arizona, and Nevada. T. F. Dougherty, head of the Department of Anatomy, lectured at the Swiss Academy of Medicine during its recent meetings and at the Pasteur Institute and the Radium Institute of the Pasteur Laboratories. Urs P. Hoesley has been named assistant research professor of anatomy at the medical school.

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### Grants and Fellowships

The Air University has developed a plan for the award of fellowships, visiting professorships, and other awards in cooperation with the Board of Control for Southern Regional Education. The visiting professorships are for one year and provide an opportunity for postdoctoral research; the fellowships are renewable. Other awards (without compensation) will be granted to certain graduate students or faculty members in civilian institutions. Research opportunities are offered in the USAF School of Aviation Medicine, Research Studies Institute, and Human Resources Research Institute. For further information, write to Commanding General, Maxwell AF Base, Alabama, attention Air University Secretary.

The first Frank M Chapman Memorial Fellowships, for research in ornithology, have been awarded by the American Museum of Natural History to Richard B. Fischer, Cornell; Byron E. Harrell, University of Minnesota; Owen A. Knorr, Colorado College; Mrs. Robert Schultz, University of Washington; and David K. Wetherbee, Clark University. Additional grants may be made next spring; in general student investigators will be given preference.

Dupont Fellowships at Columbia have been awarded to Ferdinand Freudeustein, a refugee from Nazi Germany (mechanical engineering); Palmer W. Townsend, of Bergenfield, N. J. (chemical engineering); and Douglas W. Wylie, New York City (chemistry).

Two Educational Testing Service psychometric fellowships for 1952-53 will be awarded for study in the Graduate School at Princeton. Competence in mathematics and psychology is a prerequisite. Information and application blanks will be available about Nov. 1 from Director of Psychometric Fellowship Program, 20 Nassau St., Princeton.

James Chadwick, a master of Gonville and Caius College, Cambridge University, who identified the neutron as a part of the atom, will be awarded the Franklin Medal, highest honor given by The Franklin Institute, Philadelphia, at the Medal Day ceremonies on Wednesday, Oct. 17. Thirteen other outstanding scientists will receive awards at the same time. Recipients of the Howard N. Potts Medal are Basil Albert Adams, of Barry, Glamorgan, Wales, and Eric Leighton Holmes, of Wollaston, Northants, Eng., for their pioneer work in the use of synthetic organic resins for ion exchange; and Clifford M. Foust, of the General Electric Company, for his work on high-

voltage surge phenomena. John Price Wetherill medals will be given to Samuel C. Collins, of MIT; Reid B. Gray, of Baltimore; and Gaylord W. Penney, of Carnegie Institution. Howard O. McMahon, of Arthur D. Little, Inc., will receive the Edward Longstreth Medal; A. C. Walker, of Bell Telephone Company Laboratories, the Louis E. Levy Medal; Hermann Lemp, of Ridgewood, N. J., the George R. Henderson Medal; Samuel A. Greeley, of Chicago, the Frank P. Brown Medal; and John Chipman, of MIT, the Francis J. Clamer Medal. John F. McKee, of Ardmore, Pa., and Jean Mercier, of Paris, will be awarded Certificates of Merit, which have been given since 1882 for noteworthy inventions.

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The School of Mathematics of the Institute for Advanced Study will allocate a small number of grantsin-aid to gifted young mathematicians and mathematical physicists to study and do research at Princeton during 1952–53. Application blanks may be obtained from the institute, Princeton University, and are returnable by Jan. 1.

The National Foundation for Infantile Paralysis has available a limited number of postdoctoral fellowships covering a period of one to five years, with stipends ranging from \$3,600 to \$7,000 a year. Complete information may be obtained from Division of Professional Education, National Foundation for Infantile Paralysis, 120 Broadway, New York 5.

#### Meetings and Elections

The American Society of Tropical Medicine, the National Malaria Society, the American Society of Parasitologists, and the American Academy of Tropical Medicine will hold their annual meetings conjointly at the Congress Hotel, Chicago, Nov. 15-17. Special features will be panel discussions on "Tropical Medicine in the Armed Forces" and "Resistance of Insects to Insecticides," and a symposium on "The Ecology of Vectors of Parasitic Diseases."

Central States Section of the Botanical Society of America elected the following officers at its recent St. Louis meeting: John Aikman, Iowa State, chairman; Winona Welch, Depauw, vice chairman; Robert L. Hulbary, State University of Iowa, secretary-treasurer; and Ernest C. Abbe, University of Minnesota, member of the Executive Committee for a three-year term.

The eleventh biennial convention of the national social science honor society, Pi Gammu Mu, convened in Washington, D. C., June 15-16. In the concluding session, W. Leon Godshall, professor of international relations, Lehigh University, became president. He is a charter member and has, for the past number of years, served as chancellor of the Eastern Region. Dr. Godshall succeeds S. Howard Patterson, professor of economics, University of Pennsylvania, who, after 14 years as national president, assumes the title of emeritus president and trustee-at-large. Other new national officers include: first vice presidents, Andrew

J. Kress, of the School of Foreign Service, Georgetown University; Ciarence W. Schroeder, Bradley University; and C. B. Kuhlmann, Hamline University. Paul J. Fitz-Patrick, head of the Department of Economics, Catholic University of America, was elected secretary-treasurer. Effic B. Urquhart will continue as executive secretary. Edward W. Carter, associate professor of political science, University of Pennsylvania, is editor of Social Science, the official journal. Frances Lopez, of Texas Lambda Chapter in Our Lady of the Lake College, San Antonio, was elected to the newly created office of student adviser. By action of the Board of Trustees, all income from investments in the future will be added to the Scholarship Fund, and applications for the first scholarship will be received by the board at its annual meeting in December 1951 in Philadelphia.

The following officers for 1951–52 have been elected by the Plant Science Seminar: James C. Munch, chairman; Carl H. Johnson and J. Russell Anderson, vice chairmen; Edward P. Claus, secretary-treasurer; and Heber W. Youngken, Jr., Elmer L. Hammond, Dr. Munch, and Dr. Claus, members of the Executive Committee. The 1952 seminar will be held in Philadelphia during August just prior to the centennial meeting of the American Pharmaceutical Association.

The Second Symposium on Chemical-Biological Correlation, sponsored by the Chemical-Biological Coordination Center, NRC, will be held Oct. 24–25, 1952 (not 1951, as published in SCIENCE Sept. 28), at the auditorium of the National Academy of Sciences, 2101 Constitution Ave., Washington, D. C. The Program Committee, consisting of Harry Eagle, Remington Kellogg, John W. Mitchell, J. Franklin Yeager, and C. P. Huttrer, has decided on the following title: "Mechanism of Drug Action and Drug Resistance." The detailed program will be available within a few months. Those interested are invited to register with the Symposium Committee. No registration fee will be charged.

#### Miscellaneous

The American Council of Learned Societies has begun a \$43,000 study under the direction of Fletcher Wellemeyer, which when completed will list the nation's language specialists, economists, historians, anthropologists, archaeologists, demographers, international law experts, philosophy and religion students, political scientists, sociologists, and statisticians. Main point being investigated is knowledge of foreign countries, and first listing will be of political scientists. The Bureau of Labor Statistics will analyze the questionnaires.

An Epidemic Intelligence Service has been set up in the Public Health Service to render assistance to local health officials in investigating disease outbreaks beyond their control resources and for defense against possible biological warfare. Twenty-one medical officers have recently completed an intensive training course at the Communicable Disease Center in Atlanta

and have been assigned to selected training areas for field experience. Alexander D. Langmuir is in charge of the new service.

Immunization Information for International Travel, a new USPHS booklet recently released, details the latest facts on immunization for travelers going to any part of the world. It is available from the Superintendent of Documents, GPO, Washington, D. C., for 20 cents per copy.

#### Recent Deaths

B. M. Allen (63), radiologist, Wilmington, Del., Sept. 7; Carmelo Atonna (84), gastroentologist, New York, Aug. 29; W. E. Ayres (-), professor of dairy industry, Albany, Sept. 5; Edgardo Baldi (52), biometrician, Pallanza, Lago Maggiore, Italy, Aug. 10; Joseph A. Ball, (57), physicist, Los Angeles, Aug. 27; Raphael A. Bendove (54), diagnostician, New York, Sept. 21; Moses Benmosche (67), surgeon and writer, New York, Sept. 4; Robert M. Black (71), mining engineer, Pittsburgh, Sept. 9; Harald Blegvad (65), biologist, Copenhagen, Aug. 21; Ralph W. Bost (50), chemist, Chapel Hill, N. C., Sept. 22; Laurie R. Burgess (30), seismologist (of Washington, D. C.), San Francisco, Aug. 22; Fred M. Carter (82), retired president National Lead Co., Los Gatos, Calif., Sept. 7; William H. Chandlee (73), ophthalmologist, Philadelphia, Sept. 8; Henry A. Christian (75), pathologist, Whitefield, N. H., Aug. 24; Charles P. Clark (72), medical leader, Summit, N. J., Aug. 28; Thomas J. Clemens (80), eye specialist, Philadelphia, Sept. 17; Henry C. Cowles (—), obstetrician, Pinehurst, N. C., Sept. 9; Thomas J. Cummins (74), surgeon, Mineville, N. Y., Sept. 13.

Raoul Dautry (71), engineer, Paris, Aug. 21; James A. G. Davey, Sr. (64), tree expert, Asheville, N. C., Sept. 13; Willard J. Denno (75), former medical director, Standard Oil Company of New Jersey, New York, Aug. 29; W. R. P. Emerson (81), nutrition expert, Boston, Sept. 5; Emilio zum Felde (77), educator, Montevideo, Sept. 18; Margaret C. Ferguson (88), botanist, San Diego, Calif., Aug. 28; R. L. Flowers (80), mathematician, and former president Duke University, Durham, N. C., Aug. 24; John J. Goett (32), chemical engineer, New York, Sept. 11; Clarence E. Gordon (75), geologist and zoologist, Amherst, Mass., Aug. 28; George G. Groat (79), economist, Burlington, Vt., Sept. 10; Joseph E. Gursky

(37), pharmacist, New York, Aug. 20. Hugh Haddow, Jr. (77), mining and metallurgical engineer, Rockaway, N. J., Sept. 18; Ford P. Hall (52), dean, Division of Adult Education, Indiana University, Bloomington, Sept. 21; H. Theodore Hanson (30), biochemist, Madison, Wis., Aug. 25; Charles J. Hatfield (84), former executive director, Henry Phipps Institute, Philadelphia, Aug. 25; Caroline C. Haynes (93), botanist, New York, Sept. 6; Daniel L. Hazard (86), magnetician, Narragansett, R. I., Sept. 21; Jesse R. Hildebrand (63), assistant editor, National Geographic Magazine, Washington, D. C., Sept. 18;

Ernest A. F. Hirrschoff (70), neuropsychiatrist, Glen Ridge, N. J., Sept. 12; A. Pearson Hoover (72), consulting engineer, Pleasantville, N. Y., Sept. 16; Henry Howard (83), chemical engineer, Cambridge, Mass., Aug. 26; Nathan C. Johnson (69), advisory engineer, Englewood, N. J., Aug. 26; Theodore H. Kemp (46), electrical engineer, Elizabeth, N. J., Aug. 22; Wendell H. Kinsey (53), physicist, Storrs, Conn., Sept. 17; Louis Ladin (89), gynecologist, New York, Sept. 7; George M. Lawson (53), bacteriologist, Charlottesville, Va., Sept. 20; Frank Lehman (77), physician, Philadelphia, Aug. 26; Joseph I. Linde (65), pediatrician,

New Haven, Conn., Sept. 15.

Donald S. Mackay (59), philosopher, and past president, Pacific division, American Philosophical Association, Bend, Ore., Sept. 13; Charles A. McNeil (72), leather chemist, Hamilton, R. I., Sept. 18; William H. Manning (50), engineer, Pontiae, Mich., Aug. 24; Albert E. Marshall (67), chemist, Providence, R. I., Sept. 15; Frank B. Meeker (84), pharmacist, Newark, N. J., Sept. 4; Edward G. Miller (66), engineer, Paris, Sept. 22; Sydney B. Mitchell (73), librarian and horticulturalist, Berkeley, Calif., Sept. 21; Frazier F. Monroe (69), former health commissioner and assistant chief of medical services, Panama Canal Zone, Youngstown, Ohio, Sept. 7; Louis D. Moorhead (58), surgeon, Chicago, Sept. 14; Richard Morris (83), mathematician, Highland Park, N. J., Sept. 19; Asa H. Nuckolls (70), chemical engineer, Wheaton, Ill., Aug. 31; Ray A. Patelski (46), research chemist, New York, Sept. 7; E. F. Phillips (72), apiculturist, Ithaca, N. Y., Aug. 21; Raphael Pomeranz (55), roentgenologist, Maplewood, N. J., Aug. 20.

Claudia M. Redd (-), educator of handicapped children, West Chester, Pa., Aug. 22; Theodor Roemer (67), botanist, Halle, Germany, Sept. 9; Annie W. Sage (92), physician, Chicago, Sept. 17; Orpheus Schantz (87), naturalist, Red Bank, N. J., Sept. 2; Irving R. Schoonmaker (95), physician, Philadelphia, Sept. 14; Morris Schrero (53), technical librarian, Pittsburgh, Sept. 6; Frederick H. Schroedel (57), eonstruction engineer, Roselle, N. J., Aug. 21; Robert R. Sealock (44), physiological chemist, Kansas City, Aug. 19; Robert H. Seashore (49), psychologist, Chieago, Aug. 27; Thomas E. Sedinger, Jr. (52), agricultural employment specialist, Philadelphia, Sept. 11; George Steindorff (89), Egyptologist, North Hollywood, Calif., Aug. 28; Leigh J. Stephenson (62), consulting engineer, Ft. Wayne, Ind., Aug. 9; Paul Strubin (65), chemist, Westfield, N. J., Aug. 18; Walter E. Thrun (59), chemist, Valparaiso, Ind., Aug. 19; C. S. John Trench (71), metallurgist, Staten Island, N. Y., Aug. 20; George G. Turner (73), surgeon, London, Aug. 24; Edwin G. Van Valey (57), dentist, Ossining, N. Y., Sept. 1; Hervey S. Vassar (73), electrical engineer, Bloomfield, N. J., Aug. 30; Serge Voronov (85), surgeon, Lausanne, Switzerland, Sept. 1; Curt P. Wimmer (72), pharmaceutical chemist, New York, Sept. 9; Alfred Worcester (96), surgeon, Waltham, Mass., Aug. 28; Nikolai Zamyatin (56), electronies expert, Moscow, Sept. 11.



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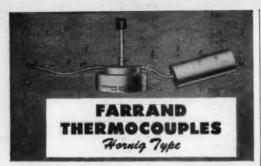
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#### Publications Received

Adventures in Aviation Education. A research report for the use of teachers and school administrators. H. E. Mehrens, Ed. Washington, D. C.: Am. Council on Educ., 1951. 401 pp. \$3.50.

Bibliography of Standard Tentative and Recommended or Recognized Methods of Analysis. Compiled under the authority of the Analytical Methods Committee of the Society of Public Analysts and other Analytical Chemists. Cambridge, Eng.: W. Heffer & Sons, 1951. 225 pp. 25s.

Community Health Education in Action. Raymond S. Patterson and Beryl J. Roberts. St. Louis: Mosby, 1951, 346 pp. \$4.50.

Essentials of Nutrition, 3rd ed. Henry C. Sherman and Caroline Sherman Lanford, New York: Macmillan, 1951, 454 pp. \$4.25.

Bernard Cioffari. Experiments in College Physics. Boston: Heath, 1951, 236 pp. \$2.75.

Herbert H. Dow: Pioneer in Creative Chemistry, Murray Campbell and Harrison Hatton. New York: Appleton-Century-Crofts, 1951. 168 pp. \$3.50.

Frontal Lobotomy and Affective Behavior: A Neuro-physiological Analysis. John F. Fulton, New York: Norton, 1951. 159 pp. \$3.00.

Grundlagen und Methoden einer Erneuerung der Systematik der höheren Pflanzen. Die Forderung dynamischer Systematik im Bereiche der Blütenpflanzen. Franz Buxbaum. Vienna: Springer-Verlag, 1951. 224 pp. \$6.20.

A Guide to Bird Finding East of the Mississippi. Olin Sewall Pettingill, Jr. New York: Oxford Univ. Press, 1951. 659 pp. \$5.00.

The Health of the Mind, J. R. Rees. New York: Norton, 1951. 207 pp. \$2.75.

Human Anatomy end Physiology. °rd ed. Nellie D. Millard and Barry G. King, Philadelphia-London: Saunders, 1951, 596 pp. \$4.25.

Integral Transforms in Mathematical Physics. C. Tranter. London: Methuen; New York: Wiley, 1951. 118 pp. \$1.50.

Intermediate Algebra. 2nd ed. Raymond W. Brink. New York: Appleton-Century-Crofts, 1951. 295 pp. \$3.00.

The John Murray Expedition, 1933-34, Scientific Reports: The Epibionts and Parasites of the Planktonic Copepoda of the Arabian Sea, Vol. IX, No. 4. R. B. Seymour Sewell. London: British Museum (Natural History), 1951. Pp. 255-394. 1£ 5s.

Labelled Atoms. The use of radioactive and stable isotopes in biology and medicine. Raymond Glascock. London: Sigma; New York: Interscience, 1951. 227 pp. \$1.25.

Laboratory Experiments in General Chemistry and Quali-tative Analysis. 2nd ed. George W. Watt. New York: McGraw-Hill, 1951. 227 pp. \$2.75.

The Lost Pharachs: The Romance of Egyptian Archaeology, Leonard Cottrell, New York: Philosophical Library, 1951. 256 pp. \$6.00.

Materials and Methods in the Study of Protosoa, Harold Kirby. Berkeley, Calif.: Univ. California Press, 1950. 72 pp. \$2.50.

Oxford Junior Encyclopaedia: Communications, Vol. IV. Laura E. Salt and Robert Sinclair, Eds. New York: Oxford Univ. Press, 1951. 496 pp. \$8.50.

Paint Film Defects: Their Causes and Cure. 1st English ed. Manfred Hess. New York: Reinhold; London: Chapman & Hall, 1951. 544 pp. \$12.00.

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Oct. 18-20. American Association of Petroleum Geologists (Regional). Commodore Perry Hotel, Austin, Tex.

Oct. 20-26. First Pan American Congress on Veterinary Medicine. Limn, Peru. Oct. 21-24. American Mining Congress (National). Bilt-

more llotel, Los Angeles. Oct. 22-23. Independent Petroleum Association of Amer-

ica (Annual). The Shamrock, Houston, Tex. Oct. 22-24. American Association of Blood Banks (Annual). Hotel Nicollet, Minneapolis.

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Oct. 22-24. American Standards Association (Annual). Waldorf-Astoria, New York.

Oct. 22-24. National Electronics Conference and Exhibition. Edgewater Beach Hotel, Chicago.

Oct. 22-25. American Academy of Pediatries (Annual). Royal York Hotel, Toronto.

Oct. 22-26. American Institute of Electrical Engineers (Fall). Hotel Cleveland, Cleveland.

Oct. 23. Association of Consulting Chemists and Chemical Engineers (Annual). New York.

Oct. 23-24. Optical Society of America (Annual). Hotel Sherman, Chicago.

Oct. 24-27. American Physical Society. Chicago.

Oct. 25. Society of Exploration Geophysicists (Eastern). Webster Hall Hotel, Pittsburgh.

Oct. 25-26. American Institute of Mining and Metallurgical Engineers (Annual fall, Petroleum Branch). Elks Club, Los Angeles.

Oct. 26-27. Institute of Mathematical Statistics. Washington, D. C.

Oct. 26-27. Kentucky Academy of Science (Fall). University of Kentucky, Louisville.

Oct. 27. American Mathematical Society. Washington, D. C.

Oct. 29-30. Society of Automotive Engineers (National Diesel Engine meeting), The Drake, Chicago; (National Transportation), Knickerbocker Hotel, Chicago, Oct. 29-31; (National Fuels and Lubricants), The Drake, Oct. 31-Nov. 1.

Oct. 29-31. Conference on Electrical Insulation (Annual). National Bureau of Standards, Washington.

Oct. 29-31. National Lubricating Grease Institute (Annual). Edgewater Beach Hotel, Chicago.

Oct. 29-Nov. 2. American Public Health Association. Civie Auditorium, San Francisco.

Oct. 29-Nov. 3. National Paint, Varnish, and Lacquer Association. Chalfonte-Haddon Hall, Atlantic City.

Oct. 29-Nov. 3. Primer Congreso Nacional de Ingenieria

Civil. Ciudad de Monterrey, Mexico. Oct. 29-Nov. 16. Inter-Agency Institute for Hospital

Administrators. Federal Security Agency, Washington. Nov. 1-2. American Association of Petroleum Geologists, Paeific Section (Fall); and Society of Exploration Geophysicists, Pacific Coast Section (Fall). Ambassador Hotel, Los Angeles.

Nov. 1-2. Mid-Continent Oil & Gas Association, Louisiana-Arkansas Division (Annual). The Roosevelt, New Orleans.

Nev. 1-3. American Physical Society, Division of Electron Physics. National Bureau of Standards, Wash-

Nov. 1-3. Entomological Society of Canada (Joint with Entomological Society of Ontario). Chateau Laurier,

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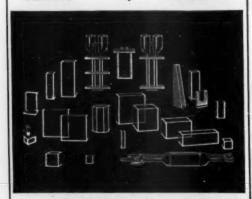
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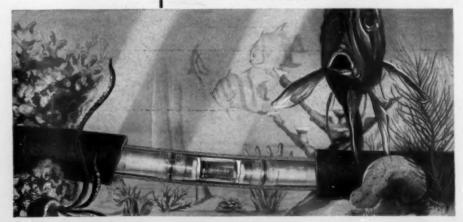
With these deep-sea amplifiers, submarine cables carry more messages . . . another example of how research in Bell Telephone Laboratories helps improve telephone service each year while costs stay low.

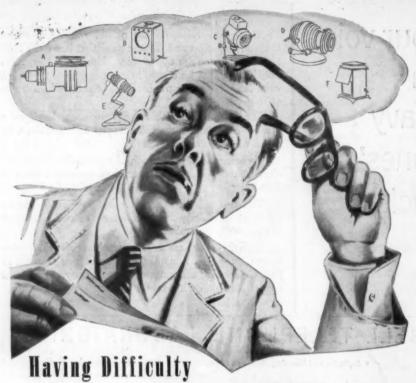
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